CITY OF COLUMBIA, MO
TRANSIT AUTOMATED PASSENGER COUNTING
SOFTWARE AGREEMENT

THIS AGREEMENT (hereinafter "Agreement") is by and between the **City of Columbia, Missouri** (hereinafter "City"), a municipal corporation, and **Urban Transportation Associates, Inc.** (hereinafter "Contractor"), a corporation with the authority to transact business within the State of Missouri, and is entered into on the date of the last signatory below (hereinafter "Effective Date"). City and Contractor are each individually referred to herein as a "Party" and collectively as the "Parties."

WITNESSETH:

WHEREAS, City is the owner and operator of a public transit system, Go COMO Transit, and has need for stand-alone automatic passenger counting software for its fleet of vehicles and other features provided for herein;

WHEREAS, Contractor submitted a proposal and pricing response to meet City's needs for such services; and

WHEREAS, City wishes to purchase, and Contractor wishes to provide, automatic passenger counting software pursuant to the terms and conditions set forth herein.

NOW, THEREFORE, in consideration of the mutual covenants set out in this Agreement and for other good and valuable consideration (the receipt and sufficiency of which is hereby acknowledged), the Parties agree as follows:

1.   CONTRACT DOCUMENTS. The Contract Documents include this Agreement and the following attachments and exhibits, which are incorporated herein by reference:

    Exhibit:
    A   Contractor's Scope of Services
    B   Contractor Pricing Page

In the event of a conflict between the terms of any of the Contract Documents and the terms of this Agreement, the terms of this Agreement control.

2.   PROJECT, STANDARDS AND SPECIFICATIONS AND TIMING.

    a.   The Project shall consist of all software, hardware and services necessary for complete implementation and use of the systems, as set forth more fully in the Contract Documents.

b.   Contractor shall be responsible for, and agrees to perform, all work and services according to the specifications, material standards, procedures and quality standards set out in the Contract Documents.

c.   *Timing of Work.* Contractor shall start work promptly, after receipt of a Notice to Proceed, and shall complete Phases of the Project as set forth in the Contract Documents, unless otherwise agreed to in writing by the Parties.

d.   *Material and Workmanship.* All materials provided by Contractor shall be new materials of high quality which shall give long life and reliable operation. All equipment shall be modern in design and shall not have been in prior service except as required by factory tests. The workmanship shall be of high quality in every detail.

e.   *Repairs and/or Replacement of Defective Portions.* Contractor shall be responsible for a period of five (5) years from and after the date of final acceptance by the City of the work covered by this Contract, for any repairs or replacements caused by defective materials, workmanship, or equipment which, in the judgment of the City, shall become necessary during such period. Contractor shall undertake with due diligence to make the aforesaid repairs and/or replacements within ten (10) days after receiving written notice that such repairs or replacements are necessary. If Contractor should neglect to begin such repairs or replacements within this period, or, in case of emergency, where in the judgment of the City, delay would cause serious loss or damage, the repairs and/or replacements may be made by the City and charged to Contractor.

3.   PAYMENT

a.   *Pricing.* For the initial five (5) year term of this Agreement, both Parties agree the price for the Project will be set at the amounts provided in the Contractor's Pricing Page, attached hereto as Exhibit B. After the initial term, Contractor's fees may increase as provided in this Agreement. Any fee increase more than five percent (5%) shall require a contract amendment.

b.   *Billing.* Contractor shall invoice the City in writing on a monthly basis based on the services that have been rendered and at prices consistent with the pricing provided for this Agreement.

c.   *Payments.* City agrees to pay all uncontested amounts of the invoice within thirty (30) days of receipt of an invoice. City expressly reserves the right to disapprove in whole or in part a request for payment where the services rendered are not performed in a timely or satisfactory manner. If an amount of invoice is contested, then City shall notify Contractor in writing within twenty (20) days of receipt of the invoice. Within this written notice, City shall provide the reasoning for City's disapproval. Contractor shall either (a) respond to the City's notice to contest in writing justifying its position, or (b) exercise due diligence in curing the issue raised. If a cure cannot be reached, then the Parties may mutually reach an agreement as to an acceptable alternative.

d.   *Not to Exceed Amount.* For the initial five (5) year term, it is expressly understood by both Parties that in no event shall the cumulative amount of payment from City to Contractor exceed **One Hundred Fifteen Thousand Dollars ($115,000)**, unless otherwise agreed to by both Parties in writing and executed as an amendment to this Agreement. After the initial five year term, City will make payments in accordance with the terms and conditions of this Agreement.

4.   TERM. The "Term" of this Agreement shall commence on the Effective Date and shall continue until the date that is five (5) years following the Effective Date, unless sooner terminated in accordance with the terms hereof. Thereafter, the Agreement shall automatically be renewed for successive terms of one (1) year (each successive term shall be called "Maintenance Term"), unless the Agreement is terminated pursuant to the provisions of this Agreement. The Agreement shall automatically terminate fifteen (15) years after Effective Date.

5.   TERMINATION.

        a.   *Termination by Mutual Agreement.* Termination of the Agreement can be made at the mutual Agreement of both Contractor and City.

        b.   *Termination for Convenience.* City is entitled to terminate this Agreement for convenience, provided that the City provides sixty (60) days advance notice to Contractor of its intent to terminate. In such event, Contractor shall immediately stop work and City shall not be liable to Contractor except for payment of actual work performed prior to such notice. Anticipatory profits and consequential damages shall not be recoverable by Contractor.

        c.   *Termination upon Default.* Upon the occurrence of an event of Default, the non-Defaulting Party shall be entitled to immediately terminate this Agreement. A Party shall be considered in Default of this Agreement upon:

                (i) A failure by a Party to pay any amount due hereunder, where such failure is not cured within thirty (30) days after written notice from the other Party of such failure to pay; or

                (ii) Either Party has (a) commenced a voluntary case under any bankruptcy law, applied for or consented to the appointment of, or the taking of possession by, a receiver, trustee, assignee, custodian or liquidator of all or a substantial part of its assets, (b) failed, or admitted in writing its inability generally, to pay its debts as such debts become due, (c) made a general assignment for the benefit of creditors, (d) been adjudicated bankrupt or has filed a petition or an answer seeking an arrangement with creditors, (e) taken advantage of any insolvency law or shall have submitted an answer admitting the material allegations of a petition in bankruptcy or insolvency proceeding, (f) become subject to an order, judgment or decree for relief, entered in an involuntary case, without the application, approval or consent of such Party any

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court of competent jurisdiction appointing a receiver, trustee, assignee, custodian or liquidator, for a substantial part of any of its assets and such order, judgment or decree shall continue unstayed and in effect for any period of one hundred eighty (180) consecutive days, (g) filed a voluntary petition in bankruptcy, (h) failed to remove an involuntary petition in bankruptcy filed against it within one hundred eighty (180) days of the filing thereof, or (i) become subject to an order for relief under the provisions of the United States Bankruptcy Act, 1 1 U.S.C. § 301; or

(iii) Any Party's actual fraud or other material misconduct in connection with this Agreement or the performance of its obligations under this Agreement; or

(iv) Any other default that has a material adverse effect on the non-defaulting Party if such default has not been cured by the defaulting Party within thirty (30) days after receiving written notice from the non-defaulting Party setting forth, in reasonable detail, the nature of such default and its impact on the non-defaulting Party; provided, however, that, in the case of any such default that is not reasonably capable of being cured within the 30-day cure period, the defaulting Party shall have additional time as necessary to cure the default if it commences to cure the default within such 30-day cure period and it diligently and continuously pursues such cure.

(v) The purported assignment of this Agreement in a manner inconsistent with the terms of this Agreement.

d.   Upon the occurrence of an Event of Default by a Party, the non-defaulting Party shall have the following rights:

(i) To terminate this Agreement by providing at least sixty (60) days prior written notice to the other Party of its intent to exercise its termination rights, unless such Event of Default is cured prior to the date of termination;

(jj) To suspend performance of its obligations and duties hereunder immediately upon delivering written notice to the defaulting Party of its intent to exercise its suspension rights; and

(iii) To pursue any other remedy given under this Agreement or now or hereafter existing at law or in equity or otherwise.

6.   DATA OWNERSHIP AND STORAGE. Contractor does not own any data obtained or gathered by or through the City's use of the Software and Services and any information derived therefrom. Contractor shall not sell, give away, or transfer any personal customer data obtained by Contractor through the use of these systems by City. Contractor covenants that any data from the City, its employees or those persons or entities using the City's transit system through the use of the software, or derived therefrom shall be stored in the United States of America. The data or any information

derived therefrom shall not be transferred, moved, or stored to or at any location outside the United States of America. All such data and any information derived therefrom shall be confidential and proprietary information belonging to either the City or its transit customers. Contractor shall not sell or give away any such City or customer data or information derived therefrom.

     a.   Contractor retains control over design elements of the user interface, including but not limited to elements such as bus and stop icons, map colors, banners, point of interest identification, and other related elements.

     b.   Contractor may use information in order to enhance the user experience. Information may be used in a manner specified by future agreements for platforms that will be jointly agreed upon by the Contractor and City.

     c.   Contractor will only use information once it has:

     (i) Received permission from customer for such uses

     (ii) Removed any personally identifying data

All information is owned by the City or its transit customers, and Contractor agrees not to sell or transfer any City or personal customer data.

7.   LICENSING, WARRANTY, MAINTENANCE, SUBSCRIPTIONS and CLOUD HOSTING.

     a.   *Licensing.* Contractor hereby sells and licenses to City and City agrees to purchase and license from Contractor for City's purposes perpetual, site licenses for all the Software included in Contract Documents. Contractor hereby grants to City any and all licenses needed for Project as set forth in the Contract Documents.

     b.   *Maintenance, Subscriptions and Cloud Hosting Services.* The Parties agree that City is paying for five years of maintenance, subscriptions and cloud hosting services during the initial Term. During any Maintenance Term, Contractor's standard fees associated with maintenance, subscriptions, and cloud hosting may increase or decrease. Contractor agrees to provide City with pricing for maintenance, subscriptions, and cloud hosting at the lowest rate offered to Contractor's customers. Any fee increase of more than five percent (5%) shall require a contract amendment.

     c.   *Warranties and Maintenance.* The Contractor warrants that all components provided under this Agreement shall be: newly manufactured equipment or assembled from newly manufactured parts; approved by Underwriter's Laboratories; and, will be free from defects in workmanship or material for a period of five (5) years from the date of final system acceptance. During the five (5) year warranty period, the Contractor shall furnish all replacement new parts, shipping costs, repaired parts, service labor, travel costs, and other repair costs at no cost to the City.

1.   Third party software. Contractor warrants that all third party software products, brands, types, etc., have been recommended based on Contractor's understanding of the City's operating environment and that such third party software products, brands, types, etc., shall operate as demonstrated by and documented or represented by Contractor. Contractor further warrants that Contractor has the right to license said third party software products, brands, types, etc.

2.   Third party hardware. Any and all hardware products, brands, types, etc., that Contractor provides to City pursuant to this Agreement shall be warranted to perform satisfactorily (defined as minimum ninety eight percent (98%) uptime during normal business hours and maximum three (3) second response time to non-query commands) for five (5) years from the signing of this Agreement, assuming local or other hardware support contracts are in effect for routine maintenance and diagnostics.

3.   Warranty of Fitness for a Particular Purpose. Given City's documentation about the City's particular purpose, the Contractor acknowledges at the time this Agreement is in force that Contractor has (1) reason and opportunity to know the particular purpose for which products are required, and (2) that the City is relying on the Contractor's experience and knowledge of these products to provide those which are most suitable and appropriate. Therefore, the Contractor warrants that the system is fit for the purposes for which it is intended as described in this Agreement.

4.   Resolution and Response Time Warranty. Contractor warrants that all Resolution and Response Times delineated below shall be adhered to as follows:

a.   Priority 1 support issues are defined as: Mission Critical — Software is down [undiagnosed but feared critical; situation may require a restore and Software use is suspended until a diagnosis is given.

(i) Response to first call time limit — within two (2) business hours

(ii) Resolution time limit — CONTRACTOR shall use its best efforts to resolve within one (1) business day

(iii) If Contractor and City are on a support telephone call to resolve a Priority 1 support issue at the time that normal support hours end, Contractor support representatives will remain on the call past the normal support hours to provide what assistance can be provided at no additional cost. City acknowledges that programmers will not be available at that time.

Penalty for not adhering to time limits - City shall receive a one percent (1%) credit against the annual Support fees, per incident, with a

maximum of three (3) incidents or three percent (3%) reduction in any one year.

b.   Priority 2 support issues are defined as: Critical Issue — Software is not down, but operations are negatively impacted.

(i) Response to first call time limit — within four business hours

(ii) Resolution time limit — Contractor shall use its best efforts to resolve within one (1) business week

(iii) Penalty for not adhering to time limits - City shall receive a one percent (1%) credit against the annual Support fees, per incident, with a maximum of three (3) incidents or three percent (3%) reduction in any one (1) year.

c.   Priority 3 support issues are defined as: Non-Critical Issue — resolution period to be mutually agreed upon.

(i) Response to first call time limit — within twenty-four (24) business hours

(ii) Resolution time limit — Contractor shall use its best efforts to resolve within one (1) business week.

(iii) Penalty for not adhering to time limits - City shall receive a one percent (1%) credit against the annual Support fees, per incident, with a maximum of three (3) incidents or three percent (3%) reduction in any one (1) year.

d.   Continuity of Warranty. City may continue the Warranty protection described above by purchasing and paying for on-going Annual Support services described below during the Maintenance Terms. By doing so, all Warranty, Warranty of Fitness for a Particular Use, and Resolution and Response Time Warranty conditions above shall remain in effect, in perpetuity (except for the "Third party hardware" clause above), as long as payments for Annual Support are kept current.

e.   Final Acceptance of the System. The system proposed shall be defined to be finally accepted by City after the installation of the equipment, training, and successful completion of the following performance examinations: system hardware examination, software performance examination, system functional competence examination, system capacity examination, full-load processing capacity examination, system availability examination, approval of as-builts, training, and system documentation. The City shall be the sole judge of whether all conditions for final acceptance criteria have been met.

8.   UPGRADES TO SOFTWARE. City is entitled to receive any maintenance updates to the Service that Contractor may release or provide to its other customers that improves or maintains the stability of the Service ("Updates") at no cost to Customer. If new features that add new functionality to the Service ("Upgrades") are offered for sale to Contractor's other customers, such features will be offered to Customer at or below the prevailing rate. In the case where Contractor provides new features to Customer at no charge for testing or trial, the continued availability, performance, or usefulness of such features are not guaranteed or warranted by Contractor and such features may be revoked at any time. Contractor reserves the right to charge for any significant additional data requests made by the City over the course of the contract, including but not limited to bus number changes, route changes, and related additions, deletions, or alterations to system data.

9.   SUNSHINE LAW. Access to data shall be granted in accordance with Missouri's open records law. The City of Columbia Public Works Department Records Custodian shall serve as the custodian of records for open records requests. Contractor shall provide access, at no additional costs, to the City of Columbia Public Works Department records custodian or his or her designee to all City's data and the data to allow for the fulfillment of Sunshine requests. Contractor shall provide all reasonable requests for information free of charge, including records and contracts data. Contractor reserves the right to charge City for any data requests which present a burden on business operations, including access to database information.

10.   RECORDS RETENTION.

    a.   Pursuant to Missouri Law, both Parties agree that all records shall be retained in accordance with Missouri law and records retention schedules adopted by the Local Records Board and in accordance with the requirements of the Federal Grant. If there is a conflict between Missouri Law, then applicable retention schedule adopted by the Local Records Board, and the Grant requirements, the longer retention period shall apply.

    b.   *Effect of Termination and Records Retention.* At the close date for this Agreement, either through contract duration or termination, Contractor shall provide City with all records as defined by law. Contractor shall provide to City at no cost a method of migrating or exporting all electronic records or data in a usable basis in a method and format acceptable to City. At City's sole option, City may choose to negotiate a new contract for ongoing storage and access to all City records and data as needed to comply with the Missouri Sunshine Law and the record retention requirements of the Grant or as required by law.

11.   DEVELOPMENT OF ADDITIONAL APPLICATIONS USING DATA.

    a.   Contractor shall provide access to data through an API to allow City to develop additional applications using the data, to hire others to develop additional applications, to allow members of the public to develop additional applications,

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including but not limited to work for hire or a contest type event. Contractor shall provide access to data to allow any such applications to utilize real time transit data.

b. *Notice of Changes in API.* To allow for the functioning of any applications using Data through the API, Contractor shall notify City in advance of any changes in the formatting of the API no later than thirty (30) days prior to the change.

12. DATA SECURITY.

a. Contractor shall at all times comply with the Contract Documents, Good Financial Industry and Accounting Practices, Applicable Laws, City's Red Flag Policy, SAS70 auditing standards, and the CITY's Cloud Computing Requirements.

b. Contractor shall comply with the City's Red Flag policy and timely report any Red Flags to the CITY's Program Administrator. Said report shall include Red Flags detected by Contractor or its subcontractors or subsidiaries and Contractor's response to the Red Flags so detected.

c. Contractor shall provide City with a copy of its existing Red Flag policies and procedures, and shall promptly provide copies of any changes to its Red Flag policies and procedures.

d. If any Software upgrade includes the storage or use of credit cards and debit cards, Contractor shall comply and shall warrant that the Contractor's software and services comply with the Payment Card Industry (PCI) Data Security Standards; Good Financial Industry and Accounting Practices; SAS70 auditing standards; Visa, Mastercard, and Discover Card Rules and Regulations; NACHA (The Electronic Payments Association) Rules; and the City's Red Flag Policy.

e. *Duty to Report.* Contractor shall maintain the security of City content and data and that of City's customers and any user that is stored in or in any way connected with Software Products and applications. If either Party believes or suspects that security has been breached or data compromised whether it be from harmful code or otherwise, the Party shall notify the Other Party of the issue or possible security breach within forty-eight (48) hours.

f. *Binding Subcontractors and Subsidiaries to Data Security Standards.* Contractor shall include similar provisions in Contractor's Agreements with subcontractors and subsidiaries who perform work or services related to these Software Products and or the City's Data contained therein or in the cloud storage.

13. NO HARMFUL CODE. Contractor warrants that the Software Products do not contain Harmful Code. For purposes of this Agreement, "Harmful Code" is any code containing any program, routine, or device which is designed to delete, disable, deactivate, interfere with or otherwise harm any software, program, data, device, system or service, including without limitation, any time bomb, virus, drop dead device,

malicious logic, worm, Trojan horse or trap or back door. Contractor shall include in contracts with any subcontractor a provision which prohibits the use of Harmful Code.

14.   CONTRACTOR'S INSURANCE. The CONTRACTOR shall not commence work under this Contract until they have obtained all insurance required under this paragraph and such insurance has been approved by the CITY, nor shall the CONTRACTOR allow any subcontractor to commence work on the Project until all similar insurance required of subcontractor has been so obtained and approved. All policies shall be in amounts, form, and with companies satisfactory to the CITY which must carry an A-6 or better rating as listed in the A.M. Best or equivalent rating guide.

a.   WORKERS COMPENSATION INSURANCE: The CONTRACTOR shall take out and maintain during the life of this Contract Employers Liability and Workers Compensation Insurance for all of their employees employed at the site of the work, and in case any work is sublet, the CONTRACTOR shall require the subcontractor similarly to provide Workers Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. Workers Compensation coverage shall meet Missouri statutory limits. Employers Liability limits shall be $500,000.00 each employee, $500,000.00 each accident, and $500,000.00 policy limit. Jn case any class of employees engaged in hazardous work under this Contract at the site of the work is not protected under the Workers Compensation Statute, the CONTRACTOR shall provide and shall cause each subcontractor to provide Employers Liability Insurance for the protection of their employees not otherwise protected.

b.   COMMERCIAL GENERAL LIABILITY INSURANCE: CONTRACTOR shall carry Commercial General Liability Insurance written on ISO occurrence form CG 00 01 07 98 or later edition (or a substitute form providing equivalent coverage) and shall cover all operations by or on behalf of the CONTRACTOR, providing insurance for bodily injury liability and property damage liability for the limits indicated below and for the following coverage:

(1)   Premises and Operations
(2)   Products and Completed Operations

Contractual Liability insurance for the obligations assumed by the CONTRACTOR under this Contract.

Personal Injury Liability and Advertising Injury Liability.

Except with respect to bodily injury and property damage included within the products and completed operations hazards, the general aggregate limit shall apply separately to the CONTRACTOR's Project under this Contract. Completed Operations coverage must be maintained for the correction period provided by the Agreement.

Limit of Liability. The Commercial General Liability policy limits shall not be less than:

$1 Each Occurrence (Combined Single Limit for Bodily Injury and Property Damage)

$1   Aggregate for Products/Completed Operations

$1   Personal Injury/Advertising Injury

$1 General Aggregate (provide endorsement to apply the General Aggregate per project, if available. If not, see Umbrella Liability section.)

Additional Insured. CITY, all of its officers, directors and employees, shall be named as Additional Insureds under the Commercial General Liability Insurance using ISO Additional Insured Endorsements CG 20 10 or substitute providing equivalent coverage. If additional insured status is required for a correction period then CG 20 37 or equivalent should also be used. These endorsements must be stated on the insurance certificate provided to CITY and a copy of the endorsements confirming coverage should accompany the insurance certificate.

Primary Coverage. The CONTRACTOR's Commercial General Liability Policy shall apply as primary insurance and any other insurance carried by CITY shall be excess only and will not contribute with CONTRACTOR's insurance. This must be stated on the insurance certificate and a copy of the endorsement confirming coverage should accompany the insurance certificate.

c.   BUSINESS AUTOMOBILE LIABILITY INSURANCE: The policy should be written on ISO form CA 0001 , CA 0005, CA 0002, CA0020 or a substitute form providing equivalent coverage and shall provide coverage for all owned, hired and non-owned vehicles. The limit of liability should be at least $1 Combined Single Limit for Bodily Injury and Property Damage each accident and should also cover Automobile Contractual Liability. The policy should name CITY and all of its officers, directors and employees as Additional Insureds. The policy shall be endorsed to be primary coverage and any other insurance carried by CITY shall be excess only and will not contribute with CONTRACTOR's insurance. To confirm coverage, a copy of the Additional Insured Endorsement should accompany the insurance certificate.

d.   UMBRELLA EXCESS LIABILITY: The CONTRACTOR should provide an umbrella excess liability policy that will provide a minimum of $1 per occurrence/$1 ,000,000 aggregate over the above listed coverages. This policy should "follow-form" of the underlying policies and complies with all insurance requirements of those policies. If the General Aggregate of the Commercial General Liability policy does not apply per project, the umbrella excess limits should be $2,000,000 per occurrence/$2,000,000 aggregate.

e.   WAIVER OF SUBROGATION: The Commercial General Liability and Automobile Liability policies shall each contain a waiver of subrogation in favor of CITY and its officers, directors and employees.

f.   CERTIFICATES OF INSURANCE: As evidence of the insurance, limits and endorsements required, a standard ACORD or equivalent Certificate of Insurance executed by a duly authorized representative of each insurer shall be furnished by the

CONTRACTOR to the CITY before any work on this Project is commenced by the CONTRACTOR. CITY shall have the right, but not the obligation, to prohibit CONTRACTOR or any Subcontractor from entering the Project site until such certificates are received and approved by the CITY. With respect to insurance to be maintained after final payment, an additional certificate(s) evidencing such coverage shall be promptly provided to CITY as a precondition to final payment. The Certificate of Insurance shall provide that there will be no cancellation or reduction of coverage without thirty (30) days prior written notice to CITY. The certificate must also contain a description of the Project. Failure to maintain the insurance required herein may result in termination of the Contract at CITY's option. In the event the CONTRACTOR does not comply with the requirements of this section, CITY shall have the right, but not the obligation, to provide insurance coverage to protect CITY and charge the CONTRACTOR for the cost of that insurance. The required insurance shall be subject to the approval of CITY, but any acceptance of insurance certificates by CITY shall in no way limit or relieve the CONTRACTOR of their duties and responsibilities in this Agreement.

       g.   SUBCONTRACTORS: CONTRACTOR shall cause each Subcontractor to purchase and maintain insurance of the types and amounts specified herein. Limits of such coverage may be reduced only upon written agreement of CITY. CONTRACTOR shall provide to CITY copies of certificates evidencing coverage for each Subcontractor. Subcontractors' commercial general liability and business automobile liability insurance shall name CITY as Additional Insured and have the Waiver of Subrogation endorsements added.

15.   HOLD HARMLESS AGREEMENT. To the fullest extent not prohibited by law, Contractor shall indemnify and hold harmless the City of Columbia, its directors, officers, agents, and employees from and against all claims, damages, losses, and expenses (including but not limited to attorney's fees), of any subcontractor (meaning anyone, including but not limited to consultants having a contract with Contractor or a subcontractor for part of the services), of anyone directly or indirectly employed by Contractor or by any subcontractor, or of anyone for whose acts the Contractor or its subcontractor may be liable, in connection with providing these services. This provision does not, however, require Contractor to indemnify, hold harmless, or defend the CITY from its own negligence. Nothing in this Agreement shall constitute a waiver of sovereign immunity.

16.   NOTICE. Each notice, request, demand, statement or routine communication required or permitted under this Agreement, or any notice or communication that either Party may desire to deliver to the other, shall be in writing and shall be considered delivered effective: (a) when verified by written receipt if sent by personal courier, overnight courier, or mail; or (b) when verified by automated receipt or electronic logs if sent by facsimile or email.

The designation and titles of the person to be notified or the address of such person may be changed at any time by written notice.

IF TO CITY:	IF TO CONTRACTOR:
City of Columbia, MO	Urban Transportation Associates, Inc
Finance Department	Attn: Debbie Scheetz
ATTN: Purchasing Agent	4240 Airport Rd Suite 212
P.O. Box 6015	Cincinnati, OH 45226
Columbia, MO 65205	

With a copy to:

City of Columbia, MO
Public Works Department
ATTN: Transit Manager
P.O. Box 6015
Columbia, MO 65205

17.   AMENDMENT. No amendment, addition to, or modification of any provision hereof shall be binding upon the Parties, and neither Party shall be deemed to have waived any provision or any remedy available to it unless such amendment, addition, modification or waiver is in writing and signed by a duly authorized officer or representative of the Parties.

18.   ASSIGNMENT. This Agreement shall inure to the benefit of and be binding upon the Parties and their respective successors and permitted assigns. Neither Party shall assign this Agreement or any of its rights or obligations hereunder without the prior written consent of the other Party.

19.   SEVERABILITY. If any of the terms of this Agreement are finally held or determined to be invalid, illegal or void, all other terms of the Agreement shall remain in effect; provided that the Parties shall enter into negotiations concerning the terms affected by such decision for the purpose of achieving conformity with requirements of any applicable law and the intent of the Parties.

20.   NO THIRD PARTY BENEFICIARY. This Agreement is intended solely for the benefit of the Parties hereto and nothing contained herein shall be construed to create any duty to, or standard of care with reference to, or any liability to, or any benefit for, any Person not a Party to this Agreement.

21.   GOVERNING LAW. This Agreement shall be governed by, interpreted and enforced in accordance with the laws of the State of Missouri and/or the laws of the United States, as applicable. The venue for all litigation arising out of, or relating to this Agreement, shall be Boone County, Missouri, or the United States Western District of Missouri. The Parties hereto irrevocably agree to submit to the exclusive jurisdiction of such courts in the State of Missouri and waive any defense of forum non conveniens.

22.   NATURE OF CITY'S OBLIGATIONS. All obligations of the City under this Agreement, which require the expenditure of funds, are conditional upon the availability of funds budgeted and appropriated for that purpose.

23.   GENERAL LAWS. Contractor agrees to comply with all applicable laws, rules, regulations, ordinances, and statutes of the United States, State of Missouri, and City of Columbia, Missouri.

24.   EMPLOYMENT OF UNAUTHORIZED ALIENS PROHIBITED. Contractor agrees to comply with Missouri State Statute section 285.530 in that they shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the state of Missouri. As a condition for the award of this contract the Contractor shall, by sworn affidavit and provision of documentation, affirm its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services. Contractor shall also sign an affidavit affirming that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services. Contractor shall require each subcontractor to affirmatively state in its contract with Contractor that the subcontractor shall not knowingly employ, hire for employment or continue to employ an unauthorized alien to perform work within the state of Missouri. Contractor shall also require each subcontractor to provide Contractor with a sworn affidavit under the penalty of perjury attesting to the fact that the subcontractor's employees are lawfully present in the United States.

25.   AMERICANS WITH DISABILITIES ACT. Contractor's Software Products and applications shall comply with the requirements of the Americans with Disabilities Act and comply with the requirements of any rules or regulations of the federal, state, or local government related thereto.

26.   COMPLIANCE WITH GRANT REQUIREMENTS. The Parties agree that grant funds from the United States Department of Transportation (hereinafter, "FTA") are being used for this purchase. Contractor shall comply with all conditions and requirements of the Grant, including, but not limited to those set forth herein. Contractor shall include in contracts with subcontractors provisions that require subcontractors to comply with the requirements of this section.

        a.   Contractor shall at all times comply with all applicable FTA regulations, policies, procedures and directives, including without limitation, those listed directly or by reference in the Agreement between the City and FTA (FTA MA (18) dated October 1, 2011), as they may be amended or promulgated from time to time during the term of this Contract. CONTRACTOR's failure to so comply shall constitute a material breach of this Contract.

        b.   CIVIL RIGHTS.
                1.   Nondiscrimination. In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with

Disabilities Act of 1990, 42 U.S. C. § 12132, and Federal transit law at 49 U.S.C. § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing regulations that the Federal Transit Administration (FTA) may issue.

2. Equal Employment Opportunity. The following equal employment opportunity requirements apply to this Contract: Race, Color, Creed, National Origin or Sex. In accordance with Title VII of the Civil Rights Act, as amended, 42. U.S.C. §2000e, et seq., and Federal transit laws at 49 U.S.C. §5332, the Contractor agrees to comply with all applicable equal opportunity requirements of the U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor" 41 C.F.R. Parts 60 et seq., (which implement Executive Order No. 1 1246, "Equal Employment Opportunity," as amended by Executive Order No. 1 1375, "Amending Executive Order 1 1246 Relating to Equal Employment Opportunity," 42 U.S.C. 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

Age. In accordance with Section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § 623 and Federal transit law at 49 U.S.C. §5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

Disabilities. In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. §121 12, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 C.F.R. Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

ADA Access Requirements. In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 121 12 and section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. § 794, the Contractor agrees that it will comply with the requirements of U.S. Department of Transportation regulations, "Transportation Services for Individuals with Disabilities (ADA)," 49

CFR Part 37; and U.S. Department of Transportation regulations, "Americans with Disabilities Accessibility Specifications for Transportation Vehicles," 36 CFR Part 1192 and 49 CFR Part 38, pertaining to facilities and equipment to be used in public transportation. In addition, the Contractor agrees to comply with the requirements of 49 U.S.C. S 5301 (d) which expresses the Federal policy that the elderly and persons with disabilities have the same right as other persons to use mass transportation services and facilities, and that special efforts shall be made in planning and designing those services and facilities to implement transportation accessibility rights for elderly persons and persons with disabilities. CONTRACTOR shall make the services, programs, and activities governed by this Agreement accessible to the disabled as required by the Americans with Disabilities Act and its implementing regulations.

c.   DEBARMENT AND SUSPENSION CERTIFICATION. The Contractor, its principals and any affiliates, shall certify that it is not included in the "U.S. General Services Administration's List of Parties Excluded from Federal Procurement or Non-procurement Programs," as defined at 49 CFR Part 29, Subpart C. The Contractor agrees to refrain from awarding any subcontract of any amount (at any tier) to a debarred or suspended subcontractor, and to obtain a similar certification from any subcontractor (at any tier) seeking a contract exceeding $25,000. The Contractor agrees to provide the City a copy of each conditioned debarment or suspension certification provided by a prospective subcontractor at any tier, and to refrain from awarding a subcontract with any party that has submitted a conditioned debarment or suspension certification until FTA approval is obtained. Contractor also agrees to comply with any implementing requirements FTA may issue.

d.   DISADVANTAGED BUSINESS ENTERPRISE (DBE). This Contract is subject to the requirements of Title 49, Code of Federal Regulations, Part 26, Participation by Disadvantaged Business Enterprises in Department of Transportation Financial Assistance Programs. The national goal for participation of Disadvantaged Business Enterprises (DBE's) is 10 percent. The City's overall goal for DBE participation is 12.5 percent. A separate contract goal has not been established for this procurement. CONTRACTOR shall not discriminate on the basis of race, color national origin, or sex in the performance of this Contract. The Contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of this DOT-assisted contract. Failure by the CONTRACTOR to carry out these requirements is a material breach of this Contract, which may result in the termination of this Contract or such other remedy as the City deems appropriate. Each subcontract the CONTRACTOR signs with a subcontractor must include the assurance in this paragraph (see 49 C.F.R. 26.13(b)). CONTRACTOR shall be required to report its DBE participation obtained through race-neutral means throughout the Term. CONTRACTOR is required to pay its subcontractors performing work related to this contract for satisfactory performance of that work no later than 30 days after the CONTRACTOR's receipt of payment for that work from CITY. CONTRACTOR must promptly notify CITY whenever a DBE subcontractor performing work related to this contract is terminated or fails to complete its work and must make good faith efforts to engage another DBE subcontractor to perform at least the same amount of work. CONTRACTOR may not terminate any DBE

subcontractor and perform that work through its own forces or those of an affiliate without the prior written consent of CITY.

e.   DISCLAIMER OF FEDERAL GOVERNMENT OBLIGATIONS OR LIABILITY. CONTRACTOR, and any subcontractors acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of this contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the CONTRACTOR, or any other party (whether or not a party to this Contract) pertaining to any matter resulting from this Contract. It is further agreed that the clause shall be included in each subcontract and shall not be modified, except to identify the subcontractor who will be subject to its provision.

f.   ENVIRONMENTAL REGULATIONS.

1.   Clean Air. CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §7401 et seq. CONTRACTOR agrees to report, and to require each subcontractor at every tier receiving more than $100,000 from this Contract to report any violation of these requirements resulting from any project implementation activity to CITY. CITY will in turn, report each violation as required to assure notification to FTA and the appropriate U.S. EPA Regional Office.

2.   Clean Water. CONTRACTOR agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. § 1251 et seq. CONTRACTOR agrees to report, and requires each subcontractor at every tier receiving more than $100,000 from this Contract to report any violation of these requirements resulting from any project implementation activity to the CITY. CONTRACTOR understands that the CITY will in turn, report each violation as required to assure notification to FTA and the appropriate U.S. EPA Regional Office.

3.   Energy Conservation. CONTRACTOR agrees to comply with mandatory standards and policies relating to energy efficiency, which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

4.   Recovered Materials/Recycle Products. CONTRACTOR agrees to comply with all the requirements of Section 60002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to the regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

g.   FRAUD AND FALSE OR FRAUDULENT STATEMENTS OR RELATED ACTS. CONTRACTOR acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et seq. and U.S DOT regulations, "Program Fraud Civil Remedies," 49 CFR Part 31 , apply to its actions pertaining to the Project. Upon execution of the Contract, CONTRACTOR certifies and affirms the truthfulness and accuracy of any statement it has made, it makes, or may make pertaining to the project covered under this Contract. In addition to other penalties that may be applicable, CONTRACTOR further acknowledges that if it makes a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on CONTRACTOR to the extent the Federal Government deems appropriate. CONTRACTOR also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government in connection with this Contract, the Government reserves the right to impose on the Contractor the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 53070) (1), to the extent the Federal Government deems appropriate. CONTRACTOR agrees to include these clauses in each subcontract, and it is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

h.   INCORPORATION OF FEDERAL TRANSIT ADMINISTRATION TERMS. The provisions in this Contract include certain standard terms and conditions required by the U.S. Department of Transportation (DOT), whether or not expressly set forth. All contractual provisions required by DOT, as set forth in FTA Circular 4220. IE or any revision thereto, are hereby incorporated by reference. Anything to the contrary herein notwithstanding and to the extent allowed by law, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in the Contract. CONTRACTOR shall not perform any act, fail to perform any act, or refuse to comply with any the CITY requests that would cause the CITY to be in violation of the FTA terms and conditions.

i.   LOBBYING RESTRICTIONS. CONTRACTOR is bound by its certification contained in its offer to the CITY regarding the use of federal or non-federal funds to influence, or attempt to influence any federal officer or employee regarding the award, execution, continuation, or any similar action of any federal grant or other activities as defined in 31 U.S.C. 1352, and 49 CFR Part 20. CONTRACTOR agrees to comply with this requirement throughout the term of the Contract. CONTRACTOR shall obtain the same certification and disclosure required by the LOBBYING RESTRICTIONS from each subcontractor and shall file the required certifications and disclosures with the CITY.

j.   NATIONAL INTELLIGENT TRANSPORTATION SYSTEMS ARCHITECTURE AND STANDARDS. CONTRACTOR agrees to conform, to the extent applicable, to the National Intelligent Transportation Systems (ITS) Architecture and Standards as required by SAFETEA-LU § 5307(c), 23 U.S.C. § 512 note, and CONTRACTOR agrees to comply with FTA Notice, "FTA National ITS Architecture

Policy on Transit Projects" 66 Fed. Reg. 1455, January 8, 2001, and any further implementing directives, except to the extent FTA determines otherwise in writing.

k.   PRIVACY ACT REQUIREMENTS. CONTRACTOR agrees to comply with, and assures the compliance of its employees and subcontractors with the information restrictions and other applicable requirements of the Privacy Act of 1 974, 5 U.S.C. S 552. Among other things, CONTRACTOR agrees to obtain the express consent of the CITY and/or the Federal Government before the CONTRACTOR or its employees operate a system of records on behalf of the CITY or Federal Government. CONTRACTOR understands that the requirements of the Privacy Act, including the civil and criminal penalties for violation of that Act, apply to all individuals involved, and that failure to comply with the terms of the Privacy Act may result in termination of the underlying Agreement. CONTRACTOR agrees that strict privacy will be maintained in the collection, storage, use, transfer, access to and/or security of information protected by the Privacy Act. CONTRACTOR agrees to protect such information, and to limit the use of the information to that required by the contract.

l.   RECORD RETENTION AND ACCESS. CONTRACTOR agrees that, during the course of this Agreement and any extensions thereof, and for three years thereafter, it will maintain intact and readily accessible all data, documents, reports, records, contracts, and supporting materials relating to this Contract. In the event of litigation or settlement of claims arising from the performance of this Contract, CONTRACT shall maintain same until such litigation, appeals, claims or exceptions related thereto have been disposed of. CONTRACTOR shall permit the CITY, the Secretary of Transportation, the FTA Administrator, the Comptroller General of the United States, and, the CITY to inspect all work, materials, sites, payrolls, and other data and records, and to audit the books, records, and accounts of CONTRACTOR relating to its performance under this Contract. CONTRACTOR shall permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

m.   SEAT BELT USE POLICY. CONTRACTOR agrees to comply with terms of Executive Order No. 13043 "Increasing Seat Belt Use in the United States."

n.   TEXTING WHILE DRIVING AND DISTRACTED DRIVING. Consistent with Executive Order No. 13513, "Federal Leadership on Reducing Text Messaging While Driving," October 1 , 2009, 23 U.S.C. Section 402 note, and DOT Order 3902.10, "Text Messaging While Driving," December 30, 2009, CONTRACTOR agrees to promote policies and initiatives for its employees and other personnel that adopt and promote safety policies to decrease crashes by distracted drivers, including policies to ban text messaging while driving, and to encourage each subcontractor to do the same.

o.   BUY AMERICA. CONTRACTOR shall comply with 49 U.S.C. S5323(j), and 49 CFR. Part 661 , which provide that federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661 .7 and include final assembly in

the United States for 15 passenger vans and 15 passenger wagons produced by Chrysler Corporation, microcomputer equipment & software. Separate requirements for rolling stock are set out at 53230) (2) (C) and 49 CFR Part 661.11 . Rolling stock not subject to a general waiver must be manufactured in the United States and have a 60 percent domestic content.

27.   CONTRACTOR'S REPRESENTATIONS AND WARRANTIES. CONTRACTOR represents and warrants as follows:

   a.   Contractor is a corporation with authority to transact business in the State of Missouri;

   b.   Contractor has the power and authority to enter into and perform this Agreement and is not prohibited from entering into this Agreement or discharging and performing all covenants and obligations on its part to be performed under and pursuant to this Agreement;

   c.   Contractor has taken all action required by law in order to approve, execute and deliver this Agreement;

   d.   The execution and delivery of this Agreement, the consummation of the transactions contemplated herein and the fulfillment of and compliance by Contractor with the provisions of this Agreement will not conflict with or constitute a breach of or a default under or require any consent, license or approval that has not been obtained pursuant to any of the terms, conditions or provisions of any law, rule or regulation, any order, judgment, writ, injunction, decree, determination, award or other instrument or legal requirement of any court or other agency of government, the documents of formation of Contractor or any contractual limitation, restriction or outstanding trust indenture, deed of trust, mortgage, loan agreement, lease, other evidence of indebtedness or any other agreement or instrument to which CONTRACTOR is a party or by which it or any of its property is bound and will not result in a breach of or a default under any of the foregoing;

   e.   Contractor has taken all such action as may be necessary or advisable and proper to authorize this Agreement, the execution and delivery hereof, and the consummation of transactions contemplated hereby;

   f.   To Contractor's knowledge, there are no actions, proceedings, judgments, rulings or orders issued by, or pending before any court or other governmental body that would materially adversely affect Contractor's ability to perform its obligations under this Agreement; and

   g.   This Agreement is a legal, valid and binding obligation of CONTRACTOR enforceable in accordance with its terms, except as limited by laws of general applicability limiting the enforcement of creditor's rights or by the exercise of judicial discretion in accordance with general principles of equity.

28.   USE OF SUBCONTRACTORS. The Parties agree that Contractor shall subcontract using the subcontractors Contractor identified in Exhibit A. No additional or other substitute subcontractor shall be used without the prior written approval of the City. Contractor shall file with City a complete list of subcontractors together with a list of the services and equipment provided by subcontractor. This list shall be submitted in writing to the City as soon as subcontracts are made and approved by the City. Any subcontractor performing work under this contract at the direction of the Contractor shall file a "Final Receipt of Payment and Release" form. This completed form shall be submitted to the CITY along with application for final payment.

29.   NO WAIVER OF IMMUNITIES. In no event shall the language of this Agreement constitute or be construed as a waiver or limitation for either Party's rights or defense with regard to each Party's applicable sovereign, governmental, or official immunities and protections as provided by federal and state constitution and laws.

30.   MISSOURI ANTI-DISCRIMINATION AGAINST ISRAEL ACT. Pursuant to Missouri Revised Statute Section 34.600, Contractor certifies it is not currently engaged in and shall not, for the duration of this Agreement, engage in a boycott of goods or services from the State of Israel; companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel; or persons or entities doing business in the State of Israel.

31.   GENERAL NONDISCRIMINATION. Pursuant to Chapter 12 of the Code of Ordinances of the City of Columbia, Missouri, Contractor, and any subcontractor thereof, agrees to comply with all state, federal and local regulations regarding unlawful discrimination.

32.   ELECTRONIC AGREEMENT AND COUNTERPARTS. This Agreement may be signed in one or more counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same document. Faxed signatures, or scanned and electronically transmitted signatures, on this Agreement or any notice delivered pursuant to this Agreement, shall be deemed to have the same legal effect as original signatures on this Agreement.

33.   ENTIRE AGREEMENT. This Agreement represents the entire and integrated agreement between the Parties relative to the contracted services herein. All previous or contemporaneous contracts, representations, promises and conditions relating to the contracted services herein are superseded.

[SIGNATURES ON FOLLOWING PAGE]

IN WITNESS WHEREOF, the parties hereto have executed this Agreement by their duly authorized representatives as of the date of the last signatory to this Agreement.

CITY OF COLUMBIA, MISSOURI

BY: _____ *SSC*
De'Carlon Seewood, City Manager

DATE: _____

ATTEST:

By: _____
Sheela Amin, City Clerk

APPROVED AS TO FORM:

By: _____
Nancy Thompson, City Counselor / AK

CERTIFICATION: I hereby certify that this Agreement is within the purpose of the appropriation to which it is to be charged, account(s) to be determined at the time of the purchase order, and that there is an unencumbered balance to the credit of such account(s) sufficient to pay therefore.

BY: _____
Matthew Lue, Director of Finance

URBAN TRANSPORTATION ASSOCIATES, INC.

BY: _____

PRINTED
NAME: Thomas W Kowalski

TITLE: President/CEO

DATE: 5/14/2024

ATTEST: _____

BY: Debra A Scheetz

TITLE: Admin Manager

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EXHIBIT A

CONTRACTOR'S
SCOPE OF SERVICES

2 Scope of Work and Technical Specifications

2.1 UTA APC On-Bus Hardware - Overview

To produce high quality APC Data with the highest levels of accuracy and reliability in the industry, UTA's proposed on-bus APC hardware configuration for the City of Columbia's APC application is a comprehensive solution with over three (3) decades of experience successfully implementing APC systems at transit agencies, universities, shuttle operations, both bus and rail, throughout North America. Highly skilled engineers and technicians extensively tested and developed APC sensors, data acquisition devices, and communication equipment, and the most thorough APC analytic software package available to the transit marketplace.

In UTA's proposed hardware configuration, each City of Columbia vehicle is equipped with UTA's flexible, proven, and reliable APC Model 31 CPU. Given the presence of reliable and accurate UTA horizontal infra-red APC sensors, UTA will be providing the Model 31 APC CPU, antenna and associated cabling. Input from each vehicle door, wheelchair lift, and bicycle rack deployment will be connected to UTA's Model 31 APC CPU Module to properly allocate passenger boardings and alighting to specific bus stops.

In addition to passenger counts, the UTA Model 31 APC CPU will collect wheelchair lift activity, door open/close activity, and optionally, bicycle rack and driver's seat occupancy via digital inputs.

APC Data Records are generated upon state change of any connected digital input (door, wheelchair, bicycle rack, drivers' seat, etc.) as well as timestamps every thirty (30) seconds. Each APC Data record is inclusive of cumulative passenger counts, record type, GPS data (time, location, heading, velocity) and a unique record number identifier. The comprehensiveness of collected data assures maximum analytic utility and supports a wide range of user analytic requirements.

2.1.1 UTA APC CPU - Model 31

UTA's Model 31 APC CPU is an industrial quality multifunction vehicle tracking/telemetry CPU manufactured by CalAmp Corp. (headquartered in Oxnard, CA) which runs on an embedded 32-bit microprocessor. Based on CalAmp's LMU (Location Messaging Unit) architecture, the device provides the data storage, GPS, and wireless communication foundation of UTA's APC system. The small size (4.3" x 3.2" x 1.3") of the CPU allows for multiple mounting options with the most common being the on-board electronics cabinet. The UTA APC CPU is a highly reliable data acquisition and logging device used in many Automatic Vehicle Location (AVL) and mobile data acquisition applications (Police/Fire, Public Transit, School Bus fleets, Heavy-duty trucking fleets, etc.).

In UTA's proposed APC Hardware Configuration for the City of Columbia, the UTA APC CPU is responsible for the creation of the basic APC raw data record, APC data storage, and transmission to the UTA APC Data Collection cloud-server. The on-bus APC CPU continually (every one second) queries each APC Sensor for passenger boardings and alightings, monitors digital inputs for vehicle door state (open/close), and receives/parses incoming GPS time/location data from the onboard GPS receiver. These data (counts, location, time, door events) are recorded and stored in onboard memory in the form of UTA APC Data Records.

In UTA's StandAlone configuration, the APC data will be transferred in real-time to a UTA cloud server.

Raw APC Data Records provide the basis for all real-time and statistical reporting functions such as NTD and a wide range of service-analysis reports. Each UTA Data Record contains the following information:

- Record Type
    - Timestamp (every 30 seconds)
    - Door Open event
    - Door Close event
    - Wheelchair Deploy event
    - Wheelchair Stow event
    - System Initialization event
    - Diagnostic
- Current Date / Time
- Current Latitude / Longitude, Speed, Heading
- Current Passenger Count values from each door:
    - (continuously incrementing)
- Bus Number

Raw APC data is stored onboard the APC CPU until network connectivity to the APC Server is available. The UTA APC CPU continually attempts to establish a connection to the APC server.

With continuous network connectivity to the APC Server, the capability exists for UTA's M31 CPU to support real-time applications of APC data. Examples of this capability may include vehicle location (including speed and heading) for display on internal City of Columbia or passenger-facing Automatic Vehicle Location (AVL) applications, real-time passenger load display by bus, real-time overcrowding reporting, and optionally Bike Rack Occupancy status.

UTA's Model 31 CPU contains a high-grade, high-accuracy 50-channel GPS receiver. Due to the high reliability of the Model 31 and the exceptional GPS resolution (+/- 2 meters), UTA is frequently asked to

deploy the Model 31 APC CPU to validate the accuracy of other on-vehicle systems such as voice-annunciators and AVL systems.

UTA's Model 31 APC CPU can be integrated with RS232 devices, J1708, and J1939 vehicle networks and configurable for WLAN and cellular network technologies. Its small size and low power consumption make this unit ideal for transit applications.

With more than two million units in service worldwide public service application such as taxi, emergency response vehicles, including 60,000 units in the transit and school bus markets, UTA's Model 31 CPU has a proven history of successful performance in mobile vehicle data acquisition applications.

Accessible with a laptop and web browser (no special software required), the APC CPU will provide the City of Columbia APC Maintenance technicians with a status display of all current APC subsystem status for diagnostic purposes:

APC Status
Current APC system status

Current Time:	20 Feb 2018 16:26:31 PST
GPS Status:	Good, 3D fix, 8 sats, HDOP: 0.8
Active Hella Sensors:	3
Records stored for transmission:	562
Operating Mode:	HTTP compressed file transfer
Inbound Server:	https://datatransfer.utatransit.net
WIFI SSID:	APC Secure
WIFI Mode:	WPA2 PSK
WIFI Status:	Connected
Cellular APN:	-disabled-

Last APC record : >C,151229,76,81,41,61,051,25969,106,049,068,057,048,126,000000,13774<

Hella Sensor 1
Hella sensor status

Name:	Front Door
IP :	192.168.101.1
Last Report:	20 Feb 2018 16:26:30 PST
Last Event:	Door Open

Hella Sensor 2
Hella sensor status

Name:	Rear Door
IP :	192.168.101.2
Last Report:	20 Feb 2018 16:26:24 PST
Last Event:	Door Close

Hella Sensor 3
Hella sensor status

Name:	Aux1 Door
IP :	192.168.101.3
Last Report:	20 Feb 2018 16:26:22 PST
Last Event:	Count

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- Current Time
- GPS Status
- Comm Status
- Number of APC Sensors configured
- Number of APC data records stored
- Operating Mode
- Current I/O status (doors etc.)
- Current counts from each sensor
- Last APC data record generated

2.2 Bicycle Rack Monitoring (Optional)

The StandAlone UTA APC system can monitor the Bicycle Rack activity to provide detailed information on the utilization of the Bicycle Rack. A magnetic proximity switch is installed on the rack Pivot Plate and connected to the APC system. A strong Neodymium magnet is secured to the bike rack to ensure positive and reliable bike rack deployment indication.
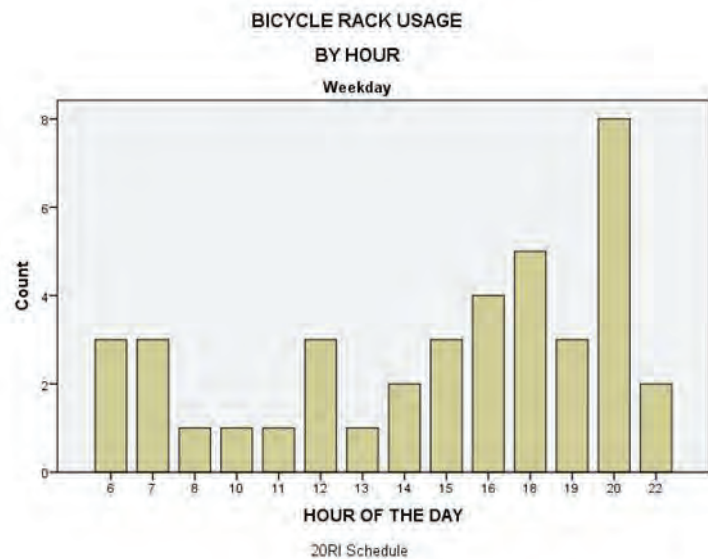
Individual observations of bike rack activity are paired with time and GPS location in the same manner as passenger counts are recorded.

2.3 UTA Multi-Slot Bike Rack Monitoring (Optional)

Another unique feature of UTA's APC system is the capability of monitoring each individual Bike Rack Slot. UTA, in collaboration with the manufacturers of Bike Rack Assemblies, has developed sensors that monitor each *individual* Bike Rack Slot.
 Similar to the Bike Rack Deployment Monitor above, strong Neodymium magnets are installed on each of the individual bike securement slots and paired with reliable, weatherproof proximity sensors that generate an APC record (Bus Number, Time, Date, Lat, Long) for each Bicycle Load and Bicycle Unload event.
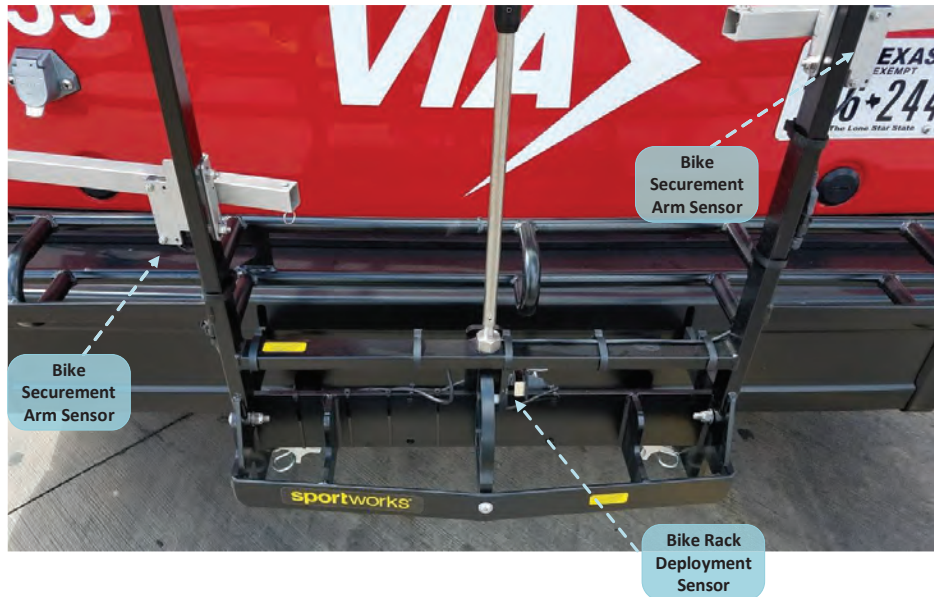
As local bicycle advocacy groups request detailed information on the usage of Bicycle Racks, the APC-generated Multi-Slot Bicycle Usage Reports allow the transit agency to provide detailed information on the frequency, time, and location of Bicycle Rack Usage. This UTA APC feature allows transit agencies to obtain specific Origin-Destination for each Bike Rack trip.

2.4 Wheelchair Monitoring (Optional)

UTA APC system monitors wheelchair deploy and stow status through the existing vehicle wiring.

APC Data Records are generated upon state change of any connected digital input i.e., wheelchair, and collected by the Model 31 APC CPU Module. Collected digital wheelchair activity can be used to generate a number of reports including wheelchair Origin Destination, summary of wheelchair lift usage, among others.

From	To	Conductor	Color	Gauge	Notes
C1.6	C2.5	W1.Green		22 AWG	APC Wheelchair Signal To LMU

From	To	Conductor	Color	Gauge	Notes
C3.5	LW1	CBL2.Red		22 AWG	APC Wheelchair signal from not stowed indicator on wheelchair controller.

Wheelchair signal input to APC sytem LMU.

Wheelchair deployed signal from wheel chari controller in dash not stowed indicator.
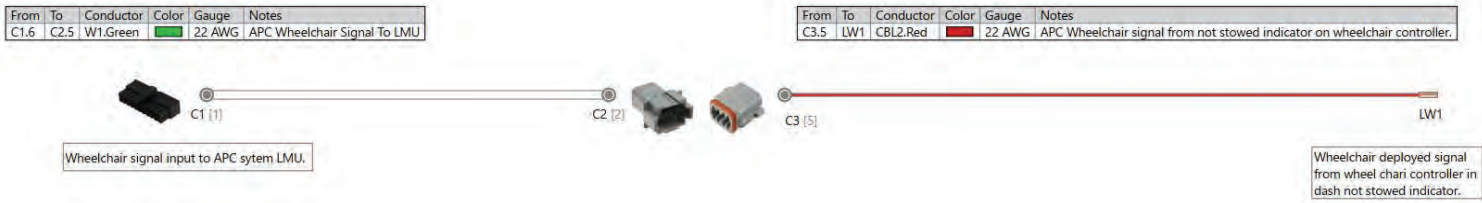
2.5 Driver Seat Monitor (Optional)

As presented earlier in this proposal, UTA's APC sensors have been consistently achieving APC Passenger Count accuracies in the 99%-100% range. The accuracy of the current APC sensors includes counting the Bus Operator as the Bus Operator boards and alights at End of Line (EOL) Locations. In order to provide the most accurate Revenue Ridership, it is critical for an APC system to identify and remove the non-revenue Boardings and Deboardings from the Bus Operator.

UTA has incorporated a Driver Seat Monitoring sensor that generates an APC record each time the Driver Seat is Occupied or Unoccupied. These APC events are the basis for UTA APC Software algorithms that generate Driver Boardings and Driver Deboardings that can be eliminated from Total APC-generated Ridership. UTA has collaborated with the manufacturers of bus operator seats (USSC and Recaro) to create reliable pressure-pad switches sized to fit within each manufacturer's seat models. Shown below is an example photo of a driver seat sensor installation.

UTA driver seat sensor is installed between the seat cushion and seat base on a USSC seat.

Experience at transit agencies that have included Driver Seat Monitoring in the APC configuration indicates approx. 3%-4% of all Boardings/Alightings on a standard two (2) door transit bus are generated by the Driver.

2.6 UTA APC Sensor Upgrade (Optional)

As an option for City of Columbia consideration is the repalcement of the existing horizontal infra-red APC sensors with state-of-the-art APC senors.

The UTA APC passenger counting sensor is a 3-D vision-based sensing system manufactured by Hella Aglaia GmbH. It is capable of being mounted in a variety of locations over the doorways at various angles (does not need to be vertical), any rotation (does not need to be parallel to the door), and several feet inboard of the door threshold without any impact on sensor counting accuracy.

The overhead APC sensor configuration offers considerable flexibility to mount the sensor where wiring access is simplified, and aesthetics are improved.

By using sophisticated machine-vision, the Hella sensor is not only able to detect and count passengers with unparalleled accuracy, but it can also distinguish categories, or classes of passengers moving through its field of view. The UTA APC sensor can detect, and separately report Adults, Children, and non-Human objects (e.g., Bicycles).

UTA's APC sensor represents the current state-of-the art in passenger counting and object-detection technology. Combining a pair of High Dynamic Range (HDR) color video cameras with sophisticated machine-vision image processing algorithms developed by Hella GmbH, one of the world's largest automotive suppliers, the UTA APC sensor is unmatched in accuracy and reliability in passenger counting applications. Hella has drawn upon its experience in providing adaptive, radar and vision-based automotive driver-assistance and safety systems (used by some of the world's premier auto manufacturers) to produce a passenger counting sensor far superior in capability and performance to other APC sensor technologies (passive/active infrared, laser, time-of-flight).

In addition to improved accuracy over older APC technologies, the UTA APC sensor offers a variety of additional features and benefits not available with other sensors. For example, typical active/passive and time-of-flight APC sensors have a limited field of view, and therefore a fixed limit on the width of doorway which they can accurately detect passenger movement. The UTA APC sensor, by using wide-angle video cameras, is able to monitor a much wider doorway for a given mounting height than infrared technologies. In a typical transit environment, a single sensor can easily monitor a doorway over 5ft in width, where "pencil beam" or overhead infrared technologies may require two, or even three sensors for a similar door width. Furthermore, older overhead sensor technologies required a vertical, or near-vertical mounting location above the "counting line" or the point in the doorway where a passenger count would be recorded. Often, especially in rail applications, the doorway geometry does not lend itself to easy (or aesthetically pleasing) mounting of a sensor at the door threshold.
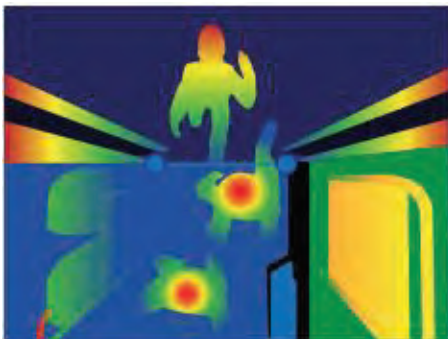
Stereoscopic, color, video cameras continually acquire images from within a user-definable area. Onboard software evaluates video images, and objects (passengers) within the detection area are identified and tracked by comparing their position against subsequent video frames. A calculated 3D image based on the distances for all pixels to the device is calculated for each frame of video. The color indicates the distance to the device (blue = far, red = near). From this 3D image, passengers and objects are detected and tracked.

Upon receipt of Passenger Count Request message, each sensor will respond independently with current (rolling) count values for both boardings and alightings as well as the Door ID# and/or IP address of each sensor for doorway identification.

Being a self-contained processing device, the UTA APC sensor provides a much more intuitive means of setup/calibration and diagnostics than older sensing systems. The UTA APC sensor provides a Web-Based interface GUI for configurating counting parameters, communication settings, and technician diagnostics. This web interface requires no special software, simply a laptop with a web browser.

A single APC Sensor will be mounted above each vehicle doorway. Mounted inboard of each door, vertically overhead, UTA's sensors are capable of accurately monitoring passenger movements regardless of door opening width, high or low-floor vehicle, or unusual doorway configurations.

UTA's APC sensor achieves accurate (99%-100%) passenger counts through the following capabilities:

Differentiation of Persons

UTA's APC sensor is not affected by variations in ambient light levels, passenger size, passenger volume (bidirectional movements, parallel movements, crowding), or passenger movement speed. Additionally, the APC sensor is capable of separately reporting passenger classes: Adult, Child, non-human objects (e.g., bicycles).

Identification of Objects

UTA's APC sensor technology is capable of distinguishing non-human objects from human passengers and either omitting non-human objects from passenger counts and/or reporting those counts separately.

Doorway/Sensor Blocking

UTA's APC sensor technology has sufficient field of view and image processing capability to be unaffected by crowding conditions or stationary objects/passengers/crew within the counting area.

Simultaneous Boarding/Alighting

UTA's APC sensors are capable of continuous identification and tracking of passenger densities up to five (5) persons per square meter. Continuous tracking allows for accurate counts in cases of bidirectional movement, double-backs and re-crossings.

2.7 APC Data Transfer

UTA's APC CPU Module (Model 31) is capable of a variety of network connectivity options for APC Data transfer. Offering flexible data transfer options is often highly beneficial to transit operators as IT infrastructure, both onboard the vehicle and fixed/backend often change or are updated within the expected lifecycle of the APC system (10-15 years+).

2.7.1 Cellular Data Transfer – StandAlone

The UTA APC Model 31 CPU is equipped with an integrated global cellular radio (LTE Category 4) capable of operating on a wide range of cellular networks including all major US carriers (Verizon, T-Mobile, AT&T, etc.), and is not restricted to solely HSPA(GSM) or CDMA (Verizon). Raw APC data is transferred automatically from each bus over cellular connection to an APC Data server.

 APC data present on UTA's Cloud Server is backed-up and stored for a minimum of five (5) years. The cellular data transfer allows for the City of Columbia real-time bus location, passenger load, and bicycle load displays.
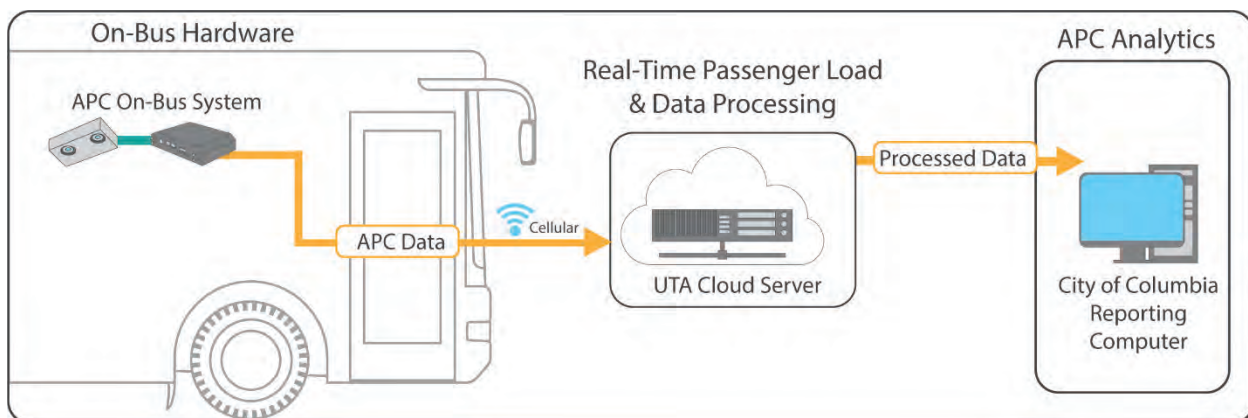
Many UTA APC sites have chosen to configure the APC system to enable the onboard cellular capability for APC Data Transfer, including:

- Williamsburg Area Transit Authority (Williamsburg, VA) WATA
- High Point Transit System (High Point, NC) HPTS
- Niagara Frontier Transit Authority (Buffalo, NY) NFTA Metro (rail)
- Tampa, FL (HART)
- Boise, ID (VRT)
- Sacramenta, CA (SacRT)
- Albuquerque, NM (ABQRide)
- Piedmont, NC (PART)
- City of Clovis, CA

2.8 UTA APC System Accuracy

For more than thirty (30) years and in more than one-hundred-twenty-five (125+) UTA APC applications, APC Accuracy evaluations (formal or informal) have taken place at each site. UTA's APC Accuracy has consistently been evaluated to meet or exceed the specifications of the local transit agency.

One the following page is a table of past accuracy evaluations from 1998 through 2019 illustrating UTA APC accuracy as compared with skilled manual checkers. Passenger count data collected by UTA's APC system regularly concurs with manual counts in excess of 98% both in Boardings and Alightings.

Overall, UTA APC vs. Manual concurrence over 30,000 Boarding/Alighting observations exceeds 98%.

Transit Agency	Manual Ridership	APC Ridership	Manual/APC Concurrence	Manual Passenger Miles	APC Passenger Miles	Manual/APC Passenger Mile Concurrence
Tampa, FL (HART)	194	197	98.5%	876	909	96.2%
SMART (Rail)	591	593	99.7%	22,824	22,841	99.9%
Miami, FL	2,260	2,278	99.2%	9,814	10,125	96.9%
Buffalo, NY (Rail)	358	356	99.4%	991	1,005	98.6%
Savannah, GA	319	329	96.9%	1,641	1,704	96.2%
Charlottesville, VA	339	342	99.1%	1,177	1,153	98.0%
Monterey, CA	567	590	96.1%	3,893	3,815	98.0%
Salisbury, NC	144	145	99.3%	539	559	96.4%
Columbia, MO	98	101	97.0%	255	258	98.8%
Jacksonville, FL	814	856	95.1%	4,292	4,131	96.1%
Mishawaka, IN	182	179	98.3%	1,173	1,188	98.7%
Albuquerque, NM	565	579	97.6%	2,151	2,168	99.2%
Boise, ID	337	329	97.6%	2,013	2,007	99.7%
Napa, CA	124	126	98.4%	886	896	98.9%
Hanford, CA	230	240	95.8%	2,143	2,115	98.7%
Thousand Oaks, CA	194	198	98.0%	955	959	99.6%
Antioch, CA	397	414	95.9%	1,989	1,958	98.4%
San Luis Obispo, CA	494	497	99.4%	7,143	7,112	99.6%
Bloomington, IL	378	397	95.2%	907	898	99.0%
Asheville, NC	170	178	95.5%	596	584	97.9%
Columbus, OH	1,125	1,094	97.2%	5,344	5,329	99.7%

Fayetteville, NC	356	372	95.7%	1,478	1,428	96.5%
Durham, NC	664	657	98.9%	2,167	2,210	98.1%
Gainesville, FL	1,785	1,786	99.9%	4,947	5,186	95.4%
Greensboro, NC	441	440	99.8%	1,879	1,961	95.8%
Highpoint, NC	200	208	96.2%	542	557	97.3%
NCSU	753	757	99.5%	1,224	1,263	96.9%
Piedmont, NC	139	145	95.9%	2,501	2,409	96.2%
Racine, WI	242	251	96.4%	838	869	96.4%
Williamsburg, VA	302	302	100.0%	1,635	1,566	95.6%
Pinellas, FL	943	938	99.5%	5,181	5,428	95.4%
Dallas, TX	1,172	1,175	99.7%	5,611	5,539	98.7%
Ventura, CA	303	317	95.6%	6,667	6,959	95.8%
Bradenton, FL	681	700	97.3%	3,779	3,617	95.5%
Missoula, MT	578	599	96.5%	2,172	2,244	96.8%

2.9 UTA APC Web-Based Software Package (Optional)

Currently, City of Columbia (GoCOMO) has UTA's Statistical APC Software package present on a GoCOMO workstation. UTA's Statistical APC Software package has been upgraded to UTA's Web-Based software package which is the standard APC software configuration UTA is installing at UTA APC applications since 2021. It is not essential for GoCOMO to implement UTA's Web-Based software package at the present time. It is for this reason that UTA is characterizing UTA's Web-Based software package as optional.

The UTA hosted APC Analytic Reporting Tool is a password protected website with an easy-to-access intuitive interface. City of Columbia staff will interact with a user-defined, highly detailed set of reports allowing the user to dynamically query the hosted database. Users are capable of drilling down from macro-analytics (initial summary reports) to micro-analytics (detailed direct individual observations).

Overview of UTA's Web-Based APC Software Package
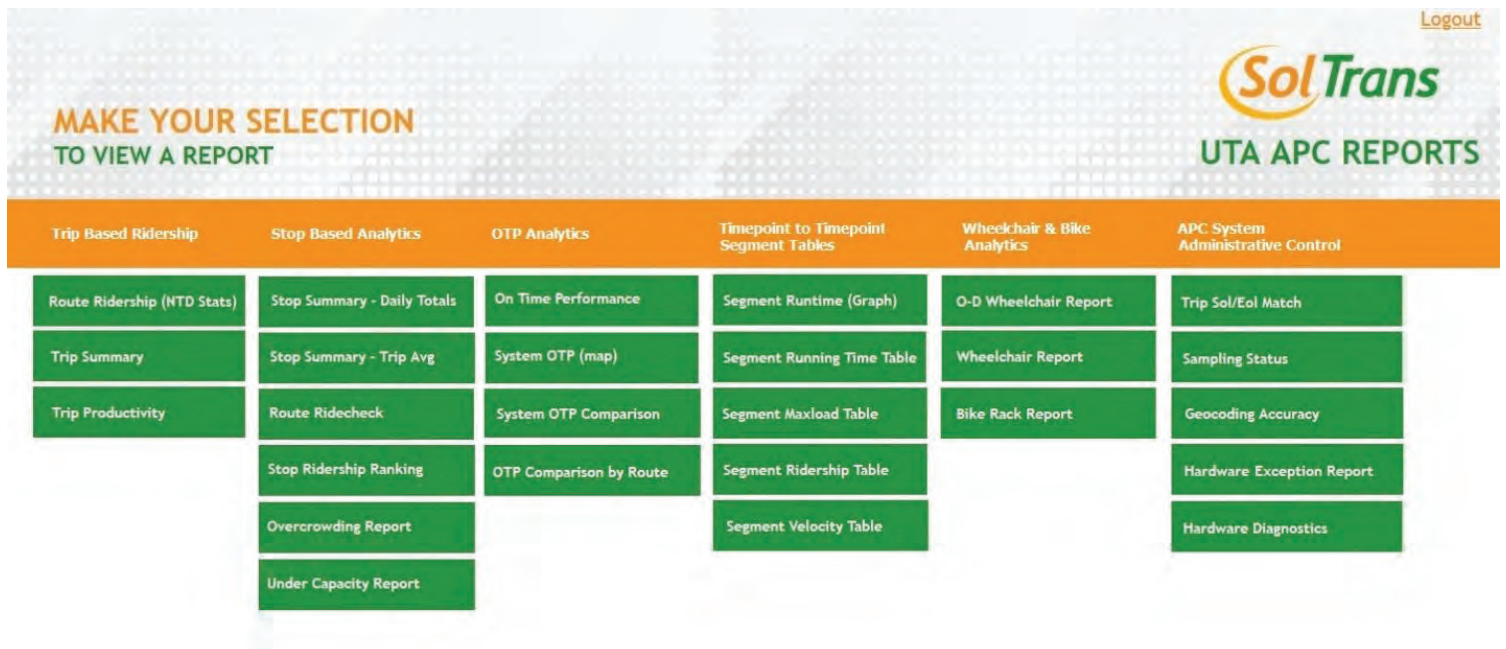
Each report push button includes an "About Report" description button providing the user specific details of the analytic content generated.

Sol Trans
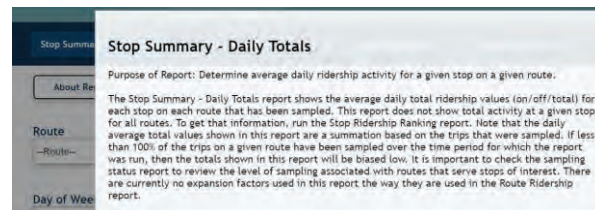
MAKE YOUR SELECTION
TO VIEW A REPORT

UTA APC REPORTS

Trip Based Ridership	Stop Based Analytics	OTP Analytics	Segment Tables	Wheelchair Analytics	Administrative Control

Stop Summary - Daily Totals	Stop Summary - Trip Avg	Route Ridecheck	Stop Ridership Ranking	Overcrowding Report	Under Capacity Report

About Report

Route

--Route--

--Route--
1 - Rancho Vallejo
2 - Crest
3 - South Vallejo
4 - Tuolumne
5 - Six Flags
6 - Tennessee
G - Green Line
B - Blue Line

Day of Week

--Day of Week--

--Day of Week--
Weekday
Saturday
Sunday

Start Date

08/01/2022

End Date

08/31/2022

Get Report

	August 2022					
Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

2.9.1 Route Ridership Reports

Many transit agencies organize their analytic reporting in monthly route level ridership totals. The UTA Route Ridership report allows you to select any date range desired by the user and will return the day type average ridership (weekday, Saturday, Sunday, Holiday) ridership during that time frame as well as the total ridership for each route and each day type during the chronological period specified.

The report reflects data collected in August-December 2021. The report contains both day type averages of UPT (AVG Daily Ridership) and PMT (AVG Daily Pass-Miles) as well as monthly totals for day type UPT (Monthly Ridership) and PMT (Monthly Pass Miles). The report has a single-click export to CSV option to quickly get the report content into a manipulable Excel file and total summary statistics at the bottom for quick answers to requested questions.

```
**********************************************
          APC-GENERATED RIDERSHIP ANALYSIS - RT DETAIL
                    Aug 2021 Schedule
          **********************************************
```

| | | SAMPLE | SAMPLE | SAMPLES | SAMPLE | SAMPLE | | | | | EXPND |
| | | | REVENUE | REVENUE | PASSENGER | TRIP | TRIPS | TRIPS | EXPNSN | EXPND | PSNGR |
DAY OF WEEK	ROUTE	RIDERS	HOURS	MILES	MILES	LENGTH	SMPLD	OPRTD	FACTOR	RIDERS	MILES
WEEKDAY											
	8	108	11.79	149	258	2.38	41	41	1.0000	108	258
	10	131	11.87	171	479	3.67	32	32	1.0000	131	479
	11	190	29.45	512	681	3.58	63	63	1.0000	190	681
	12	207	24.11	447	1,314	6.35	44	44	1.0000	207	1,314
	14	171	13.83	188	460	2.69	42	42	1.0000	171	460
	15	114	19.99	342	558	4.89	31	31	1.0000	114	558
	17	292	22.84	367	1,413	4.84	44	44	1.0000	292	1,413
	18	223	24.21	410	1,169	5.24	32	32	1.0000	223	1,169
	21	267	20.98	367	1,284	4.80	42	42	1.0000	267	1,284
	22	192	22.74	404	1,182	6.15	32	32	1.0000	192	1,182
	23	146	16.02	224	580	3.97	31	31	1.0000	146	580
	41	469	23.85	392	1,558	3.32	63	64	1.0159	477	1,583
	44	851	53.07	794	3,040	3.57	95	95	1.0000	851	3,040
	46	176	24.62	446	1,225	6.96	32	32	1.0000	176	1,225
	47	625	46.84	805	3,604	5.76	62	62	1.0000	625	3,604
	57	354	43.51	733	2,413	6.81	43	43	1.0000	354	2,413
	58	173	17.98	340	1,450	8.39	30	30	1.0000	173	1,450
	59	137	14.75	261	795	5.82	29	30	1.0345	141	822
	60	176	26.90	383	951	5.41	42	42	1.0000	176	951
	70	189	21.39	457	1,581	8.37	31	31	1.0000	189	1,581
TOTAL		491	8,192				861	950		5,204	26,046

2.9.2 Trip Reports

A basic unit of transit analysis is Trip-level summarization of raw APC data. UTA's APC Software automatically generates a Trip Ridership record which can serve as the foundation for a number of Ridership-related analytics, including NTD. Of note, unlike other APC software products, UTA APC Software does not need to identify each of the Bus Stops on a Trip in order to generate Trip-level records.

```
PAGE     1                                    Capital Area Transit System
                                ***********************************************
                                                     Rt - 011
                                                TRIP SUMMARY REPORT
                                                 Aug 2021 Schedule
                                                      Weekday
                                ***********************************************
```

ROUTE DIRECTION	TRIP DEPART TIME	BLOCK	SOL-EOL		RIDERS	TRIP TIME	TRIP DIST (MLS)	VEL (MPH)	LOAD FACTOR	120% LOAD DURTN	PASS PER HOUR	PASSENGER MILES	MAX LOAD	NUMBER OF SAMPLES
11 Outbound	06:00	1102	ELONGTRANSFER	-AVEKMILLS	3	24.2	8.1	20.1	.028	.0	6.3	7.4	3	15
	06:26	1103	ELONGTRANSFER	-AVEKMILLS	5	26.1	8.0	18.7	.100	.0	12.8	24.0	4	7
	06:56	1101	ELONGTRANSFER	-AVEKMILLS	3	27.5	8.5	18.8	.038	.0	5.3	10.5	2	16
	07:26	1104	ELONGTRANSFER	-AVEKMILLS	1	27.6	8.6	18.9	.030	.0	1.5	11.5	2	3
	07:56	1102	ELONGTRANSFER	-AVEKMILLS	2	26.8	8.7	19.5	.016	.0	3.3	4.8	2	16
	08:26	1103	ELONGTRANSFER	-AVEKMILLS	5	23.2	7.8	20.4	.064	.0	11.6	14.9	4	7
	08:56	1101	ELONGTRANSFER	-AVEKMILLS	2	25.7	8.4	19.9	.026	.0	5.5	6.8	2	16
	09:26	1104	ELONGTRANSFER	-AVEKMILLS	5	26.6	8.5	19.3	.012	.0	6.4	3.8	3	3
	09:56	1102	ELONGTRANSFER	-AVEKMILLS	2	26.0	8.7	20.3	.026	.0	4.6	7.2	1	16
	10:26	1103	ELONGTRANSFER	-AVEKMILLS	4	23.0	7.8	20.5	.065	.0	8.7	14.1	3	7
	10:56	1101	ELONGTRANSFER	-AVEKMILLS	2	25.7	8.5	20.2	.029	.0	4.8	8.2	2	16
	11:26	1104	ELONGTRANSFER	-AVEKMILLS	3	24.7	8.6	21.1	.035	.0	8.0	8.5	2	3
	11:56	1102	ELONGTRANSFER	-AVEKMILLS	2	25.9	8.7	20.1	.037	.0	5.0	10.5	2	16
	12:26	1103	ELONGTRANSFER	-AVEKMILLS	4	27.5	8.4	19.4	.048	.0	7.8	11.9	2	7
	12:56	1101	ELONGTRANSFER	-AVEKMILLS	3	26.4	8.6	19.7	.023	.0	5.2	9.6	2	16
	13:26	1104	ELONGTRANSFER	-AVEKMILLS	5	27.6	7.8	18.0	.107	.0	11.5	24.8	4	3
	13:56	1102	ELONGTRANSFER	-AVEKMILLS	3	25.7	8.5	20.0	.047	.0	5.7	8.3	2	16
	14:26	1103	ELONGTRANSFER	-AVEKMILLS	7	30.8	9.1	18.2	.097	.0	11.0	27.2	4	7
	14:56	1101	ELONGTRANSFER	-AVEKMILLS	3	25.3	8.5	20.5	.048	.0	8.8	11.1	2	15
	15:26	1104	ELONGTRANSFER	-AVEKMILLS	2	26.6	8.7	19.6	.088	.0	5.4	20.7	3	3
	15:56	1102	ELONGTRANSFER	-AVEKMILLS	3	27.4	8.5	18.8	.019	.0	6.8	4.3	2	16
	16:26	1103	ELONGTRANSFER	-AVEKMILLS	6	27.0	8.3	18.4	.057	.0	14.8	11.4	3	7
	16:56	1101	ELONGTRANSFER	-AVEKMILLS	5	28.0	8.8	19.0	.037	.0	8.9	10.0	2	13
	17:26	1104	ELONGTRANSFER	-AVEKMILLS	3	25.8	8.6	20.0	.029	.0	3.9	10.4	3	3
	17:56	1102	ELONGTRANSFER	-AVEKMILLS	3	25.8	8.6	20.1	.012	.0	5.6	4.1	1	16

TRIP RIDERSHIP-MAXLOAD PLOT

Route 011 Weekday Outbound

Aug 2021 Schedule

2.9.3 APC Ridecheck Report

The most traditional/basic type of transit analytic is the Ridecheck, which presents observations at each Bus Stop per Trip . UTA's APC Ridecheck Report automates the information historically provided by a Manual Ridecheck, making detailed and precise bus stop observations available to all users. The Ridecheck Report is often utilized when completing the NTD APC Certification procedure and validating APC system performance.

```
                                            Capital Area Transit System                                                      PAGE
                                              APC RIDERSHIP STATISTICS                                                        Weeko
                                         ****************************
                                         APC STOP LISTING BY TRIP-RIDECHECK
                                                    Rt - 044
                                            01/01/2022 - 01/31/2022
                                         ****************************
```

DIRECTION	TRIP	BLOCK	BUS NO	DATE	STOP	UNIQUE STOP NO	LOCATION	ARRIVAL TIME	DEPART TIME	ON	OFF	DEPART LOAD	PSNGR MILES	DELTA LOCATION (FEET)	DELTA INTERSTOP DISTANCE	SCHED TIME	SCHED DEV	SCHED RUN TIME	ACTUAL RUN TIME	WC LIFT
OUTBOUND	837	4401	192	01/10/2022																
					0	1433	4TH ST LAUREL - S	08:32:08	08:32:08	0	0	0	.000	17	.00	837	-4.87			0
					1	2006	FLORIDA BLVD 5TH ST - E	08:33:26	08:33:26	0	0	0	.000	786	.02					0
					2	2007	FLORIDA POST OFFICE - E	08:33:35	08:33:35	0	0	0	.000	15	.06					0
					3	2008	FLORIDA 9TH - E	08:33:47	08:33:47	0	0	0	.000	5	.08					0
					4	2009	FLORIDA 12TH - E	08:34:33	08:34:33	0	0	0	.000	44	.28					0
					5	2010	FLORIDA ST VINCENT DE PAUL -	08:34:56	08:35:04	0	0	0	.000	336	.17					0
					6	2011	FLORIDA 19TH - E	08:35:53	08:35:53	0	0	0	.000	13	.28					0
					7	1001	CATS TERMINAL	08:44:44	08:47:28	10	1	9	.000	37	.36	848	-.90	11.00	12.60	0
					8	2013	FLORIDA EUGENE - E	08:48:30	08:48:30	0	0	9	2.790	26	.31					0
					9	2014	FLORIDA GEBELIN - E	08:48:55	08:48:55	0	0	9	1.703	28	.19					0
					10	2015	FLORIDA KERNAN - E	08:49:11	08:49:11	0	0	9	1.151	40	.13					0
					11	2016	FLORIDA ACADIAN - E	08:49:18	08:49:18	0	0	9	.514	21	.06					0
					12	2017	FLORIDA BATON ROUGE GENERAL	08:49:37	08:49:37	0	0	9	1.374	37	.15					0
					13	2018	FLORIDA JASMINE - E	08:49:57	08:49:57	0	0	9	1.534	15	.17					0
					14	2019	FLORIDA N LEO - E	08:50:21	08:50:21	0	0	9	1.749	25	.19					0
					15	2020	FLORIDA N. BECK - E	08:50:47	08:50:47	0	0	9	1.896	24	.21					0
					16	2021	FLORIDA FOSTER - E	08:51:19	08:54:07	2	1	10	1.451	28	.16	855	-.97	7.00	4.05	0
					17	2022	FLORIDA BRCC - E	08:54:42	08:54:42	0	0	10	3.737	18	.37					0
					18	2809	FLORIDA FAIRFAX - E	08:54:48	08:54:48	0	0	10	.759	17	.08					0
					19	2726	FLORIDA BLVD CLOUD DR - E	08:54:56	08:54:56	0	0	10	.946	17	.09					0
					20	2024	ARDENWOOD BREC HEADQUARTERS	08:57:50	08:58:36	1	0	11	3.575	87	.36					0
					21	2025	ARDENWOOD ARDENWOOD APARTMEN	08:58:55	08:58:55	0	0	11	1.891	19	.17					0
					22	2026	ARDENWOOD HARRY - N	08:59:08	08:59:08	0	0	11	1.000	186	.09					0
					23	2027	HARRY DR CARROLLTON - E	08:59:56	08:59:56	0	0	11	2.308	12	.21					0
					24	2028	HARRY DR PLAZA APARTMENTS -	09:00:21	09:00:21	0	0	11	1.658	19	.15					0
					25	2029	HARRY DR DONMOOR - E	09:00:53	09:00:53	0	0	11	1.823	3	.17					0
					26	2030	HARRY DR HOLMES - E	09:01:16	09:01:16	0	0	11	1.417	45	.13					0
					27	2031	HARRY DR N BON MARCHE DR - E	09:01:22	09:01:22	0	0	11	.417	30	.04					0
					28	1712	HARRY DR GREATER KING DAVID	09:01:40	09:01:40	0	0	11	1.357	75	.12					0
					29	2032	HARRY DR LOBDELL - E	09:01:50	09:01:50	0	0	11	.626	325	.06					0
					30	2033	LOBDELL BON CARRE/KORNMYER -	09:02:20	09:02:20	0	0	11	2.445	45	.22	902	.33	7.00	8.30	0
					31	2034	FLORIDA LOBDELL - E	09:04:53	09:04:53	0	0	11	2.486	88	.23					0
					32	2035	FLORIDA WOODDALE - E	09:05:41	09:05:41	0	0	11	4.060	18	.37					0
					33	2036	FLORIDA FERNWOOD - E	09:06:08	09:06:08	0	0	11	2.626	13	.24					0
					35	2578	CORTANA PL PROMENADE AVE - S	09:08:53	09:09:03	0	1	10	13.575	8	1.23					0
					36	1723	CORTANA PL CENTER WAY BLVD -	09:09:28	09:09:28	0	0	10	1.718	5	.17					0
					37	1835	CORTANA PL SEARS - N	09:10:28	09:10:28	0	0	10	3.970	65	.40					0
					38	1724	CORTANA PL CROSSWAY - N	09:10:46	09:10:46	0	0	10	.916	12	.09					0
					39	1003	CORTANA PL WALMART TRANSFER	09:11:22	09:12:19	0	10	0	1.958	123	.20	910	1.37	8.00	9.03	0
				TOTAL						13	13		69.4							
				MAX								11								

2.9.4 Bus Stop Summaries

A common APC-generated analytic report is the Bus Stop Summary in which Average Daily Bus Stop Ridership is generated for each Route and the overall transit system. The example below is generated from APC data collected between August 2021 and Jan 2022.

A unique feature of UTA's Bus Stop Summary Report is the CUMULATIVE LOAD column. The CUMULATIVE LOAD variable presents the Number of Passengers being carried past each Bus Stop. Analytic questions such as Passengers being brought into the CBD during the AM Peak, and Passengers being carried over a bridge which will be shut down for maintenance can be addressed with CUMULATIVE LOAD.

```
                                           Capital Area Transit System                                                    PAGE      1
                                              APC RIDERSHIP STATISTICS
                                      ******************************
                                      APC STOP SUMMARY - DAILY TOTALS - REV002
                                                      Rt - 011
                                                Aug 2021 Schedule
                                                     Weekday
                                      ******************************
```

ROUTE	DIRECTION	UNIQUE STOP NO	SEQUENTIAL STOP NO	LOCATION	LATITUDE	LONGITUDE	ON	OFF	TOTAL	CUMULATIVE LOAD	AVERAGE DWELL TIME (MIN)	INTERSTOP DISTANCE (MILES)	OBSERVED WC LIFT
11	Outbound												
		1004	0	EARL K. LONG TRANSFER CENTER	30.503962	-91.13296	33	0	33	35	1.99	.16	26
		1138	1	AIRLINE NEW LIFE MINISTRIES	30.505493	-91.13434	0	0	0	34	.00	.12	0
		1139	2	MCCLELLAND MAPLEWOOD - N	30.506911	-91.13530	2	3	5	35	.10	.12	0
		2191	3	MCCLELLAND LSU URGENT CARE -	30.508819	-91.13575	0	0	0	35	.00	.15	0
		1140	4	MCCLELLAND GLEN OAKS - N	30.511330	-91.13550	0	1	1	32	.00	.18	0
		1141	5	GLEN OAKS ASH - E	30.511774	-91.13232	0	0	0	32	.00	.20	0
		1142	6	GLEN OAKS BLUEGRASS - E	30.511584	-91.13070	0	2	2	30	.01	.10	0
		2801	7	BLUE GRASS GLEN OAKS - N	30.511338	-91.12942	0	1	1	30	.00	.08	0
		1143	8	BLUEGRASS SUMRALL - E	30.513794	-91.12596	0	0	0	30	.00	.46	0
		1144	9	BLUEGRASS W UPLAND - N	30.515762	-91.12608	0	0	0	30	.00	.14	0
		1145	10	BLUEGRASS W MONARCH - N	30.516396	-91.12605	0	0	0	30	.00	.05	0
		1146	11	BLUEGRASS CADILLAC - N	30.519712	-91.13096	1	3	3	28	.02	.87	11
		1147	12	CADILLAC APPERSON - W	30.518547	-91.13643	1	2	3	27	.04	.39	0
		1148	13	CADILLAC SIMPLEX - W	30.518365	-91.13840	0	0	0	28	.00	.13	0
		1149	14	CADILLAC STUTZ - W	30.517755	-91.13965	0	0	0	28	.00	.12	0
		1150	15	CADILLAC KISSEL - W	30.517641	-91.14166	0	0	0	27	.00	.12	0
		1151	16	CADILLAC MOON - W	30.517509	-91.14471	0	1	1	28	.01	.19	0
		1152	17	CADILLAC PLANK - W	30.517448	-91.14663	2	1	3	28	.05	.12	2
		2290	18	PLANK 72ND - S	30.515629	-91.14762	0	1	1	30	.02	.15	2
		1153	19	72ND WINNFIELD FUNERAL HOME	30.514876	-91.14844	0	0	1	31	.00	.10	2
		1154	20	72ND MEMORIAL PARK - W	30.514748	-91.14996	0	0	0	31	.00	.10	0
		1155	21	72ND HOWELL - W	30.514842	-91.15383	0	1	1	27	.03	.25	7
		1158	22	72ND YMCA - W	30.514694	-91.15530	1	0	1	28	.01	.09	2
		1159	23	72ND YORKSHIRE - W	30.514468	-91.16139	1	1	3	28	.02	.37	2

Average Daily Total Bus Stop Ridership - Ranked

```
                       Capital Area Transit System                              PAGE     1
                         APC RIDERSHIP STATISTICS
                       ******************************
                       APC STOP SUMMARY - DAILY TOTALS
                                 Weekday
                                ALL ROUTES
                            Aug 2021 Schedule
                       ******************************
UNIQUE
STOP NO   LOCATION                        LATITUDE    LONGITUDE      ON     OFF    TOTAL   RANK
--------  --------                        ----------  ----------   -----   -----  ------   ----
    1001  CATS TERMINAL                   30.449536   -91.165479    966     792    1758      1
    1003  CORTANA PL WALMART TRANSFER     30.461280   -91.092026    327     439     766      2
    1005  MALL OF LOUISIANA               30.390293   -91.090593    260     257     517      3
    1004  EARL K. LONG TRANSFER CENTER    30.503978   -91.132705    165     128     292      4
    1999  FLORIDA 19TH - W                30.449661   -91.166672     88     144     232      5
    2344  OAK VILLA TOM DR - N            30.462233   -91.090773     73      19      92      6
    1433  4TH ST LAUREL - S               30.450536   -91.186728     30      52      82      7
    2187  BLUEBONNET PERKINS ROWE CVS     30.379691   -91.097494      6      44      50      8
    1880  CITY PLACE BARNS & NOBLE        30.423440   -91.128726     22      23      45      9
    2785  GROOM WALMART/WENDY S -         30.580952   -91.129229     27      17      43     10
    2778  L AUBERGE CASINO                30.346853   -91.150401     19      23      41     11
    2345  OAK VILLA CAR QUEST - N         30.469840   -91.089168     25      10      34     12
    2022  FLORIDA BRCC - E                30.450888   -91.134903     17      16      33     13
    2543  OCHSNER HOSPITAL                30.442522   -91.001705     16      16      32     14
    2293  GREENWELL ST PLUMBERS & STEA    30.502074   -91.133840      6      26      32     15
    1136  NORTH ST CATHOLIC PRES APTS     30.452625   -91.183786     12      18      30     16
    1200  SCENIC HWY SWAN AVE - S         30.523800   -91.180607     17      13      30     17
    1952  PLANK DELMONT VILLAGE - S       30.495554   -91.154627     23       5      29     18
    2006  FLORIDA BLVD 5TH ST - E         30.449382   -91.185509     19       9      27     19
    3028  BURBANK DR GARDERE LN - E       30.359799   -91.123178     16      12      27     20
    1989  FLORIDA FOSTER - W              30.450899   -91.139724     14      13      27     21
    1722  CORTANA PL FLORLINE - W         30.458320   -91.097017     17       8      25     22
    2889  EUROPE ST. SAINT LOUIS - W      30.441931   -91.187748     12      12      24     23
    2114  HIGHLAND HIGHLAND VILLAGE SH    30.395104   -91.161348     19       6      24     24
    2073  GARDERE BURBANK/BAYOU FOUNTA    30.360957   -91.123410     15       9      24     25
    1946  PLANK DENHAM - S                30.504760   -91.151382     18       6      24     26
    2009  FLORIDA 12TH - E                30.449629   -91.176782     20       4      24     27
    2001  FLORIDA 13TH - W                30.449660   -91.175751      4      17      21     28
    2142  ST FERDINAND GOVERNMENT LAW     30.442582   -91.186467     10      10      21     29
    2097  BURBANK BLUEBONNET ALBERTSON    30.354889   -91.111527     16       5      20     30
    1481  PERKINS RD ESSEN LN ALBERTSO    30.395807   -91.110788     18       2      20     31
    2010  FLORIDA ST VINCENT DE PAUL -    30.449638   -91.173313     15       5      20     32
    2182  BLUEBONNET BURBANK WALGREENS    30.355303   -91.109677      7      13      20     33
    1988  FLORIDA BRCC - W                30.451057   -91.135848     11       9      19     34
    2123  HIGHLAND UNION SQUARE - N       30.412436   -91.176190     14       5      19     35
    1451  PERKINS RD COLLEGE/LEE DR -     30.416609   -91.143708      3      16      19     36
    1911  HOLLYWOOD RD PIGGLY WIGGLY -    30.501095   -91.133847      6      13      19     37
    2007  FLORIDA POST OFFICE - E         30.449461   -91.182587     13       6      19     38
    2158  HIGHLAND RAPHAEL SEMMES - S     30.413543   -91.176270      8      11      19     39
    2166  HIGHLAND HIGHLAND VILLAGE SH    30.395055   -91.161318      5      13      19     40
    1463  PERKINS RD ESSEN LN - E         30.395290   -91.110278      5      14      18     41
    2153  HIGHLAND ROOSEVELT - S          30.421965   -91.178305      6      11      18     42
    2167  HIGHLAND LEE - E                30.393979   -91.159941      7      11      18     43
    2878  SCOTLAND SWAN - S               30.523974   -91.180588     11       7      18     44
```

Average Passenger Load Per Bus Stop per Trip

Embedded in UTA's Bus Stop Summary Reporting module is the generation of plots which present the Passenger Load at each Bus Stop on a given Trip. The plot below was generated for Miami-Dade Transit in order to learn the location and duration of Passenger Loads exceeding MDT's COVID Maximum Load threshold.

Passenger Load per Bus Stop per Trip
DOW: WEEKDAY, DATE: 06/22/20, ROUTE: 2, DIR: IBND, TRIP: 859, BLOCK: 20006
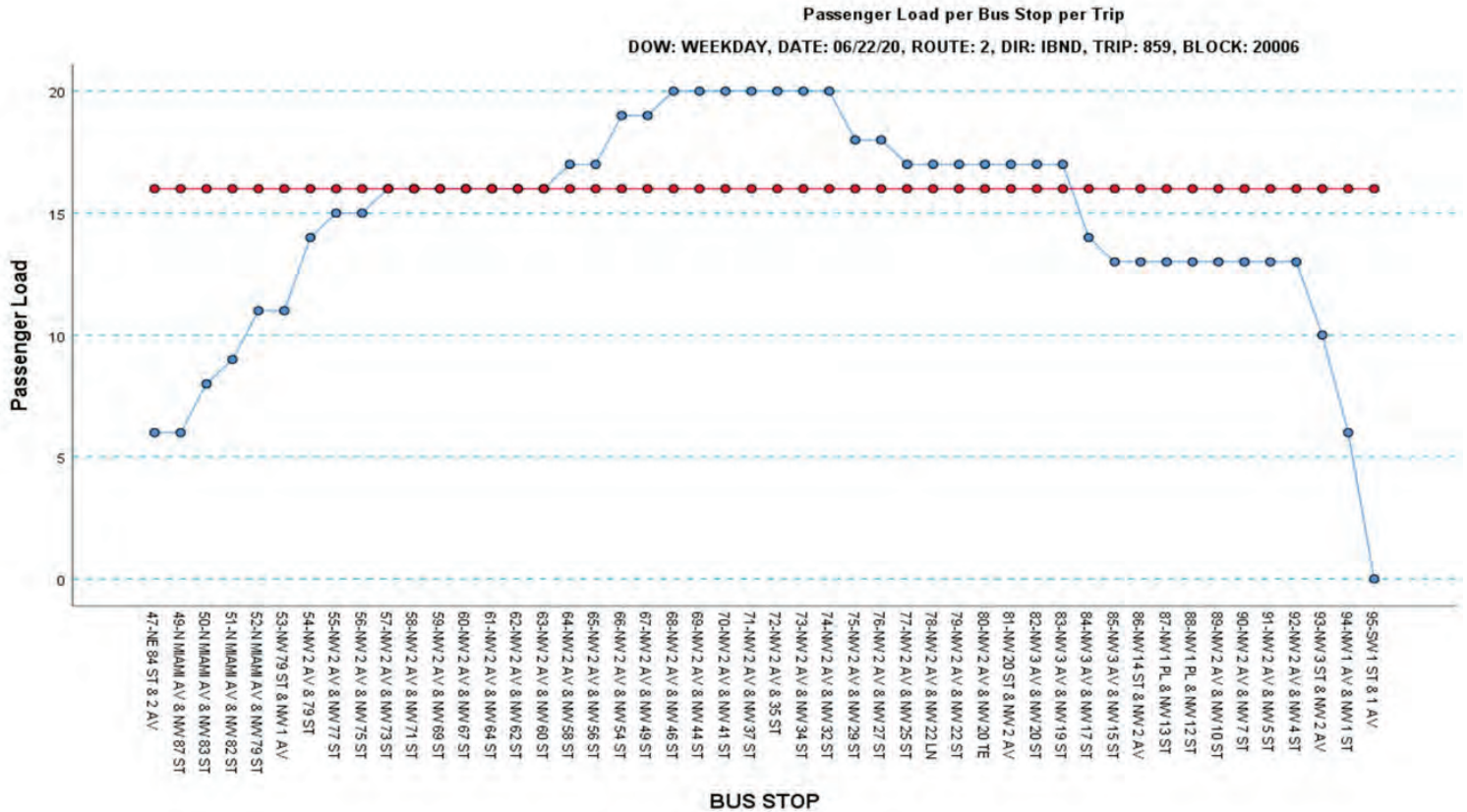
JUNE 22 - 26 2020

Average Daily Bus Stop Ridership – Map Display

The UTA Hosted APC Analytic Reporting Tool also offers quick and easy ability to see APC stop activity data plotted on a map.

Stop ID	Stop Seq. ID	Direction	Avg Lat.	Avg Long.	Stop Name	Avg Day On	Avg Day Off	Avg Day Total
91	1	Inbound	37.771760	-120.830699	1-S. MAAG AVE & E. F ST	27	0	27
92	2	Inbound	37.763981	-120.853452	2-W. F ST & LAUREL AVE	29	3	32
93	3	Inbound	37.760198	-120.862481	3-W. F ST & N. OAK AVE	19	4	23
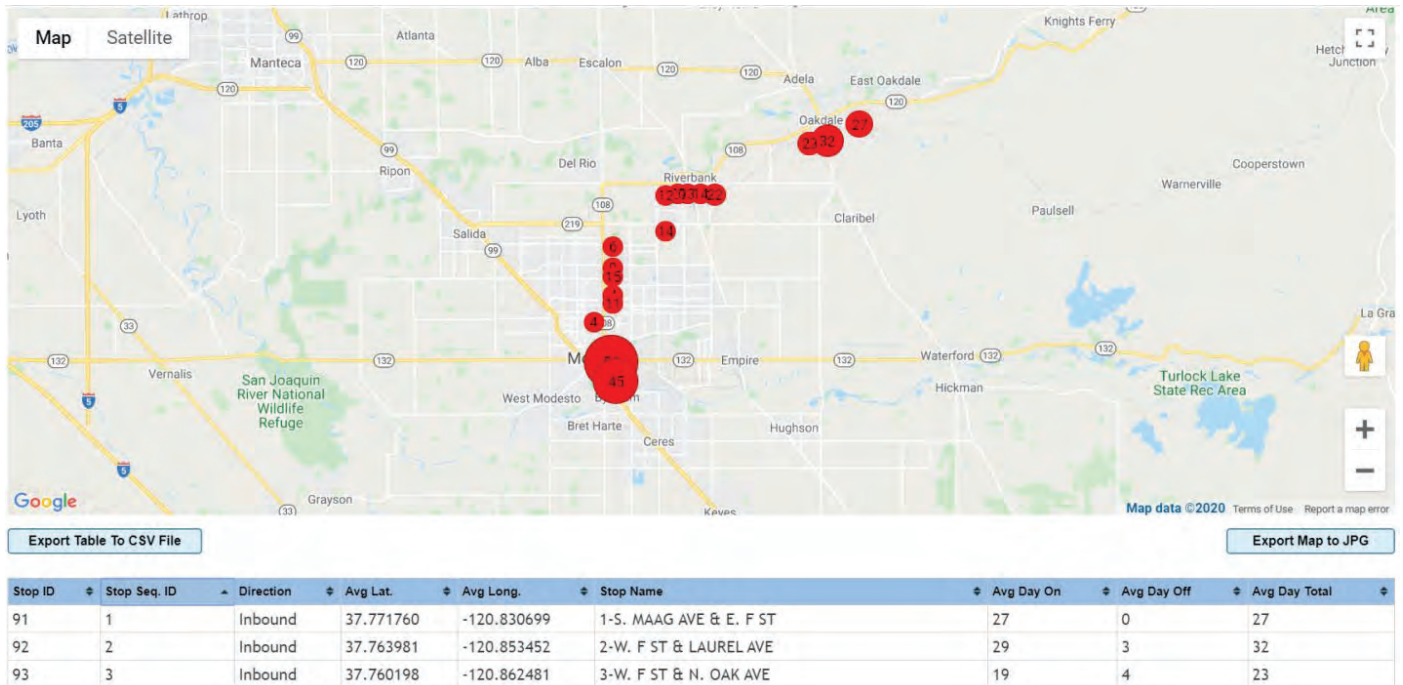
2.9.5 Service Standards Compliance Report

A key function of an APC system is to provide feedback relative to the compliance of on-street service to the local transit service standards. Often, Service Standards Compliance analyses requires considerable effort to compile. UTA's APC Software package compiles the APC data in a form that can be directly compared to local Service Standards. An example from OTS (Honolulu) is presented below:

```
                                                    OTS
                                OVERALL ROUTE RIDERSHIP/PRODUCTIVITY RANKING
                                                  WEEKDAY
                                            JUNE 2019 - AUGUST 2019
```

ROUTE CATEGORY	ROUTE	TOTAL SAMPLED TRIPS	TOTAL SCHEDLD TRIPS	TOTAL DAILY RIDERS	RIDERSHIP RANKING	PASS PER HOUR	ROUTE LOAD FACTOR	PASS PER MILE	MAX TRIP AVG MAX LOAD	PERCENT TRIP MAXLOAD GT 150%	PERCENT EARLY	PERCENT ON-TIME	PERCENT LATE	PERCENT HDWY MAINT COMPLIANCE	ACTUAL REVENUE HOURS	SCHED REVENUE HOURS	ACTUAL REVENUE MILES	SERVICE TO TOTAL HOURS	PASSMILES PER REV HOUR
URBAN TRUNK																			
	1	130	153	14,020	2	82.5	.787	9.7	91	1%	29%	54%	17%	44%	148.6	146.1	1,696	1.19	213.1
	2	115	171	17,821	1	93.0	.852	16.6	99	2%	24%	43%	33%	32%	138.9	128.8	1,598	1.19	203.3
	3	134	140	10,460	6	69.4	.865	6.6	61	0%	28%	52%	20%	42%	146.7	141.6	1,662	1.24	205.0
	4	98	113	6,010	9	59.0	.687	7.3	61	1%	29%	57%	14%	51%	79.9	87.4	950	1.28	111.9
	6	95	95	5,273	11	55.8	.567	6.5	43	0%	29%	50%	22%	38%	89.9	87.6	809	1.17	106.7
	8	66	144	3,900	16	58.0	.511	16.1	67	3%	19%	49%	32%	35%	34.9	30.3	527	1.35	97.3
	9	62	91	5,988	10	50.2	.661	7.2	52	0%	15%	50%	35%	38%	85.3	80.2	1,222	1.06	127.2
	13	115	129	12,172	3	79.6	.977	10.6	65	2%	22%	53%	25%	42%	143.9	135.7	1,286	1.22	168.5
TOTAL				75,645											868	838	9,752		
AVG						68.5	.739	10.1	67	1%	24%	51%	25%	40%				1.21	154.1

2.9.6 APC/Farebox Ridership Reporting

Historically, transit Ridership was based on information generated by the Fare Collection System. A standard feature of UTA's APC Software package is the ability to compare APC data and Farebox data at the Bus Stop level in order to better understand the difference between APC-generated and Farebox-generated Ridership. Presented below is an example of an APC/Farebox comparative analysis in which differences between APC and Farebox Ridership are highlighted:

| VEHNO	DATE	ROUTE	TRIP	DRIVER	UNIQUE STOP	STOP	STOP NAME	APC ARRIVAL TIME	APC DEPARTURE TIME	APC ON	APC OFF	FRBX TIME	FAREBOX TYPE DESCRIPTION	FAREBOX DESCRIPTION	DRIVER COUNT	FRBX RIDER
610	09/01/17															
		0		382				: :	: :			05:56:53	Driver login via GPS	Driver		0
		12		382				: :	: :			05:56:55	Got fare	TTP 18		0
		12		382				: :	: :			05:56:57	Transfer issued	Sequence Number		0
		0	616		1	1	SAVANNAH GARAGE	06:15:11	06:15:11	0	0	: :			0	0
		12		382				: :	: :			06:19:05	Period pass	TTP 13		1
		0	616		999	9999	Not Identified - Cal	06:19:07	06:19:07	0	0	: :			0	0
		0	616		999	9999	Not Identified - Cal	06:19:14	06:19:14	0	0	: :			0	0
		12	628		1	830	W 51ST & HOPKINS WB	06:28:18	06:29:20	1	0	: :			0	0
		12		382				: :	: :			06:28:46	Got fare	TTP 17		1
		12		382				: :	: :			06:28:49	Issue card	Sequence Number		0
		12	628		2	846	HOPKINS & AMARANTH NB	06:30:00	06:30:00	0	0	: :			0	0
		12	628		3	850	HOPKINS & 49TH NB	06:30:04	06:30:04	0	0	: :			0	0
		12	628		4	847	HOPKINS & 45TH NB	06:30:42	06:30:42	0	0	: :			0	0
		12	628		5	848	HOPKINS & W VICTORY LN NB	06:30:58	06:30:58	0	0	: :			0	0
		12		382				: :	: :			06:31:40	Period pass	TTP 4		1
		12	628		6	852	HOPKINS & 41ST NB	06:31:43	06:33:04	2	0	: :			0	0
		12		382				: :	: :			06:32:32	Got fare	TTP 17		1
		12		382				: :	: :			06:32:35	Issue card	Sequence Number		0
		12	628		7	1074	OGEECHEE & 39TH NB	06:34:06	06:34:06	0	0	: :			0	0
		12	628		8	854	OGEECHEE & 37TH NB	06:34:33	06:34:33	0	0	: :			0	0
		12	628		9	855	OGEECHEE & 35TH NB	06:34:58	06:34:58	0	0	: :			0	0
		12	628		10	857	OGEECHEE & 32ND NB	06:35:26	06:35:26	0	0	: :			0	0
		12		382				: :	: :			06:36:50	Period pass	TTP 2		1
		12		382				: :	: :			06:36:53	Period pass	TTP 4		1
		12	628		11	859	ANDERSON & MLK EB	06:36:55	06:37:43	5	1	: :			0	0
		12		382				: :	: :			06:36:58	Period pass	TTP 3		1
		12		382				: :	: :			06:37:07	Got fare	Preset		1
		12		382				: :	: :			06:37:14	Transfer received	Sequence Number		0

2.9.7 Segment Running Time Report with Statistical Process Control (SPC)

Critical to the creation of transit schedules that allow service to operate on-time is the generation of accurate Segment Running Times. UTA's standard Segment Running Time tables and plots are presented below. These Segment Running Time analytics are based on feedback from Schedulers at the many transit agencies utilizing UTA's APC system.

A unique feature of UTA's Running Time analyses is the application of a powerful statistical tool, Statistical Process Control (SPC), to Segment Running Times. SPC applies established statistical algorithms to raw Segment Running Time data to determine when the Running Time changes. In the plot below, the Blue Line represents the Scheduled Running Time. The Red Line represents the Average Running Time per Trip. The Black Line represented the SPC-generated recommended Running Time. This plot is intended to serve as a guide to the local Scheduler's judgement on applying the optimal Running Time per Segment per Trip.
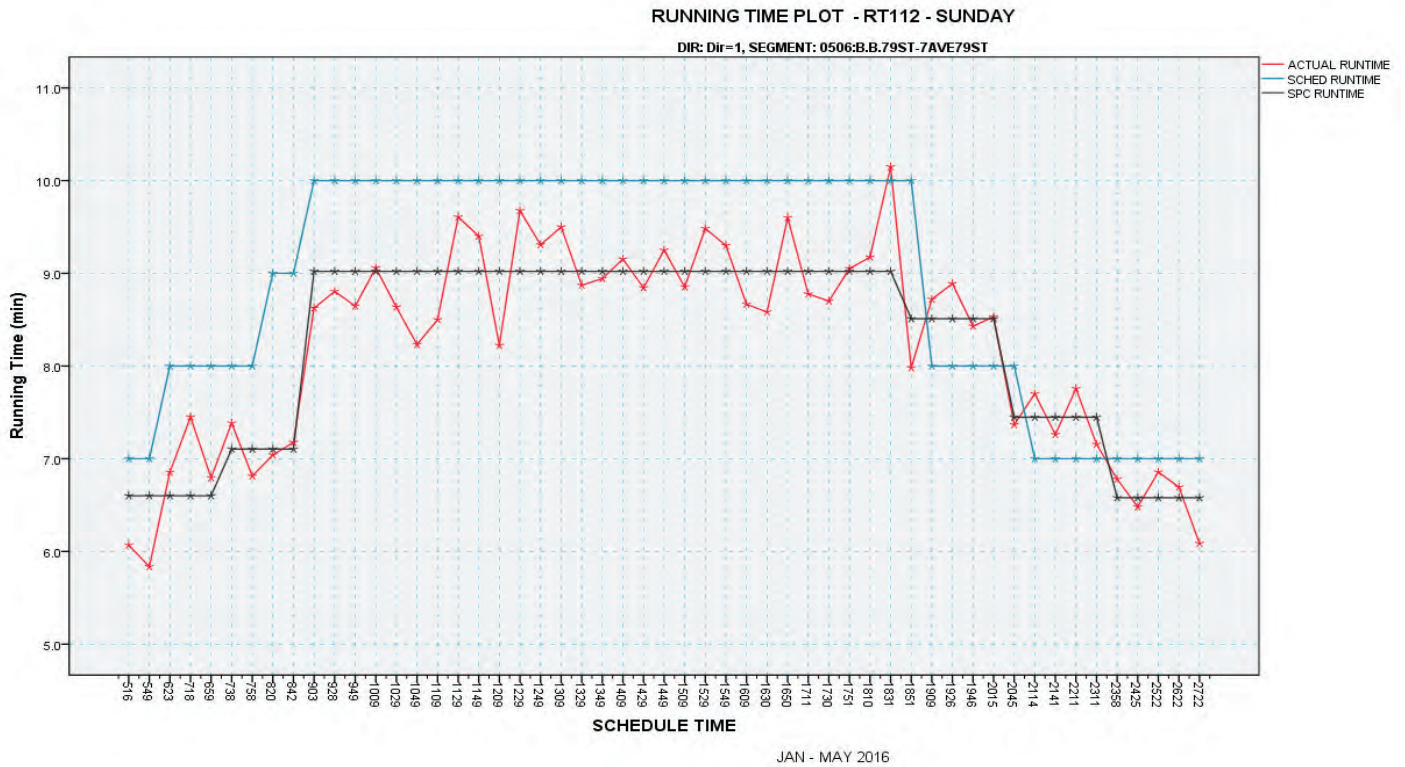
2.9.8 FTA National Transit Database (NTD) Reporting

For more than three (3) decades, UTA APC users have been meeting NTD (previously Section 15) reporting requirements using UTA APC data. Critical to UTA's NTD Reporting are the highly developed APC Administrative Control software modules that assure high quality APC data being available for NTD Reporting. UTA's APC Diagnostics, Data Quality Codes, Filter/Edit Algorithms, Sampling Status, Deployment Plans, Reference File Quality Control are but a few of UTA APC Administrative Control elements that result in high quality APC data for both NTD and non-NTD reporting.

NTD Reporting is a natural by-product of a UTA APC system. The UTA APC Reporting Software has ensured the 100% approval rating by easily recognizing and filtering out any potential bias of Unlinked Passenger Trips (UPT) and Passenger Miles Travelled (PMT) due to non-revenue door activity from operators/passengers or APC hardware malfunctions.

Critical to successful NTD Reporting is the calculation of Passenger Miles. UTA's APC Software automatically calculates Passenger Miles for each bus stop by multiplying the Passenger Load by the Inter-Stop Distance. With highly refined EOL Load Balancing algorithms assuring an accurate Passenger Load at each bus stop and algorithms that convert Lat/Long change into Inter-Stop Distance, UTA's APC Passenger Mile variable is highly accurate and auditable down to the bus stop level. Along with an accurate UTA APC Ridership variable, the Passenger Trip Length (PTL) is a standard output of UTA's Route Ridership Report.

Included in UTA's project team for the City of Columbia APC Reporting application is Mr. Keith Gates. For approximately ten (10) years before retirement in late-2015, Mr. Gates was FTA's NTD Program Manager. There is not a more qualified/knowledgeable individual relative to FTA's requirements of NTD reporting. Mr. Gates provides the statistical review of the City of Columbia's Alternative Sampling Plan.

Over the past five (5) years, UTA and FTA NTD staff meet regularly to discuss the application of UTA's APC system to NTD Reporting. FTA staff noticed the large number of UTA APC users that were successfully generating NTD Reports in contrast to the number of transit agencies utilizing non-UTA APC systems that were not able to generate NTD reports.

2.9.8.1 WE-20 Reporting Compliance

Published in the March 2023 Federal Register were *National Transit Database: Reporting Changes and Clarifications* which included a new Weekly Reporting cycle referenced as WE-20. FTA's objective for WE-20 is to provide a timely snapshot of service and ridership data to assess trends at the national level.

UTA's APC Software supports the application of APC data to WE-20 reporting. UTA's web-based reporting allows users to specify starting and ending dates of data to be included in a weekly WE-20 report. Critical to the consistent generation of accurate and reliable WE-20 weekly reports of Unlinked Passenger Trips (UPT) and Vehicle Revenue Miles (VRM) is the quality and quantity of APC data being generated.

Left table

Maximum Service Vehicles

Vehicles Operated in Annual Maximum Service (VOMS)	40
Vehicles Available for Annual Maxmium Service	52
Total Monthly Ridership VOMS	40

Periods Of Service

Field	Average Weekday Schedule	Average Saturday Schedule	Average Sunday Schedule	Weekday AM Peak	Weekday Midday	Weekday PM Peak
Time Service Begins	5:00 AM	5:00 AM	9:00 AM			
Time Service Ends	11:00 PM	7:00 PM	5:30 PM			

Services Supplied

Total Monthly Ridership VRH	38,556
Total Monthly Ridership VRM	625,994

Field	Average Weekday Schedule	Average Saturday Schedule	Average Sunday Schedule	Annual Total
Vehicles in Operation	40	2	2	N/A
Total Actual Vehicle Miles	2,991	795	128	813,695
Total Actual Vehicle Revenue Miles (VRM)	2,291	654	105	625,994
Deadhead Miles	700	141	23	187,701
Total Actual Vehicle Hours	187	46	10	50,657
Total Actual Vehicle Revenue Hours (VRH)	141	37	8	38,556
Deadhead Hours	46	9	2	12,101
Charter Service Hours	N/A	N/A	N/A	0
School Bus Hours	N/A	N/A	N/A	0

Services Consumed

Total Monthly Ridership Unlinked Passenger Trips (UPT)	96,449

Right table (spreadsheet view)

File Home Insert Page Layout Formulas Data Review View Help

B4

	A	B	C	D	E	F	G
1							
2	**Maximum Service Vehicles**						
3	Vehicles Operated in Annual Maximum Service (VOMS)	0					
4	Vehicles Available for Annual Maximum Service						
5	Total Monthly Ridership VOMS	0					
6							
7	**Periods of Service**						
8	Field	Average Weekly Schedule	Average Saturday Schedule	Average Sunday Schedule	Weekday AM Peak	Weekday Midday	Weekday PM Peak
9	Time Service Begins						
10	Time Service Ends						
11							
12	**Service Supplied**						
13	Total Monthly Ridership VRH	-					
14	Total Monthly Ridership VRM	-					
15							
16	Field	Average Weekly Schedule	Average Saturday Schedule	Average Sunday Schedule	Annual Total		
17	Vehicles in Operation				N/A		
18	Total Actual Vehicle Miles				0		
19	Total Actual Vehicle Revenue Miles (VRM)				0		
20	Deadhead Miles	0	0	0	0		
21	Total Scheduled Vehicle Revenue Miles				0		
22	Total Actual Vehicle Hours				0		
23	Total Actual Vehicle Revenue Hours (VRH)				0		
24	Deadhead Hours	0	0	0	0		
25	Charter Service Hours				0		
26	School Bus Hours				0		
27							
28	**Services Consumed**						
29	Total Monthly Ridership Unlinked Passenger Trips (UPT)	-					
30							
31	Field	Average Weekly Schedule	Average Saturday Schedule	Average Sunday Schedule	Annual Total		
32	Unlinked Passenger Trips (UPT)				0		
33	ADA Unlinked Passenger Trips (UPT)				0		
34	Sponsored Service (UPT)				0		
35	Passenger Miles Traveled (PMT)				0		

2.9.9 Ridership Change Analyses

An important function of an APC system is to provide local transit management with information describing changes in Ridership. UTA's APC Software monitors changes in Ridership and generates analytic reports at various spatial and temporal resolutions presenting the magnitude of Ridership change.

Presented below is a recent Ridership Change analysis executed for HART (Tampa) comparing pre-pandemic (Fall 2019) Ridership with current (Fall 2021) Ridership. The spatial level of detail is Route and temporal resolution is Time Period.

HART ROUTE RIDERSHIP COMPARISON.SPS

PAGE   1   ***

ROUTE RIDERSHIP BY TIME PERIOD

SIGNUPS: FALL 2021 VS FALL 2019

****

DAY OF WEEK	TIME PERIOD	ROUTE	FALL2021 RIDERS	FALL2019 RIDERS	FALL2021 FALL2019 RIDERSHIP DELTA	FALL2021 HOURS	FALL2019 HOURS	FALL2021 FALL2019 HOURS DELTA	FALL2021 MILES	FALL2019 MILES	FALL2021 FALL2019 MILES DELTA
WEEKDAY	06:00AM-09:00AM										
		1	513	677	-24.3%	17.9	19.5	-8.4%	263.7	263.4	.1%
		5	129	306	-57.8%	4.8	9.6	-50.0%	68.3	136.6	-50.0%
		6	564	980	-42.4%	17.6	23.0	-23.7%	262.0	342.9	-23.6%
		7	73	134	-45.7%	2.6	5.1	-50.0%	36.6	74.9	-51.1%
		8	145	294	-50.6%	6.1	13.6	-54.8%	102.7	207.2	-50.4%
		9	94	236	-60.3%	5.0	9.4	-47.3%	66.5	124.8	-46.7%
		12	276	521	-47.2%	9.8	14.7	-33.3%	129.5	183.6	-29.5%
		14	93	239	-61.3%	7.6	8.3	-8.5%	85.7	115.0	-25.5%
		15	98	276	-64.4%	4.6	9.2	-50.0%	67.5	131.3	-48.6%
		16	194	315	-38.6%	9.5	9.0	5.8%	120.4	121.9	-1.3%
		17	53	71	-25.4%	1.9	2.1	-11.9%	31.6	31.2	1.5%
		19	76	198	-61.5%	4.5	7.1	-36.6%	47.9	91.2	-47.5%
		24	15	47	-68.4%	1.2	2.5	-50.0%	34.2	63.0	-45.7%
		25	19	17	11.7%	2.7	1.4	100.0%	60.3	27.5	119.2%
		30	182	213	-14.6%	6.8	7.6	-10.5%	99.4	91.4	8.7%
		31	66	81	-18.4%	7.9	7.3	8.0%	155.9	154.8	.7%
		32	102	260	-60.9%	3.1	8.2	-61.8%	58.2	137.2	-57.6%
		33	98	205	-52.1%	5.8	7.4	-21.6%	92.6	125.3	-26.1%
		34	445	705	-37.0%	17.7	22.6	-21.7%	264.3	335.4	-21.2%
		36	147	310	-52.8%	5.5	11.4	-52.2%	77.3	151.9	-49.1%
		37	93	265	-64.7%	3.1	7.7	-60.5%	61.2	122.2	-49.9%
		38	138	146	-5.7%	5.1	2.2	127.6%	86.7	43.8	97.7%
		39	307	479	-35.9%	12.9	12.9	.0%	223.6	227.0	-1.5%
		42	62	291	-78.8%	2.5	6.5	-61.2%	30.7	74.4	-58.7%
		45	249	195	27.9%	12.3	8.6	42.4%	165.1	120.1	37.5%
		46	28	81	-65.0%	2.5	5.0	-50.0%	42.6	83.1	-48.7%
		48	89	122	-26.7%	3.6	3.6	.0%	68.4	68.8	-.6%
		275	100	152	-33.8%	6.2	8.2	-24.5%	119.2	157.1	-24.1%
		360	135	184	-26.8%	6.2	6.2	.0%	130.0	121.6	6.9%
		400	446	659	-32.3%	18.3	18.5	-1.1%	258.1	261.6	-1.3%
	TOTAL		5,027	8,657		215	278		3310	4190	

2.9.10   Bicycle Rack Usage Analytics (Optional)

Included in UTA's APC Software package are analytic reports presenting Wheelchair Lift and Bicycle Rack usage. Some sample reports are presented below:

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                                              PSTA
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                                 MULTI-SLOT BICYCLE RACK
                                 FULL CAPACITY REPORT
                                       WEEKDAY
                             NOVEMBER 2021 - JANUARY 2022
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					FULL CAPACITY START TIME	FULL CAPACITY END TIME	FULL CAPACITY START LOCATION	FULL CAPACITY END LOCATION	FULL CAPACITY TIME (MIN)
DAY OF WEEK	DATE	BUS NO	ROUTE	DIR					
WEEKDAY	11/17/21								
		12107	34	N	10:43:12	10:53:20	USHWY19N&110THAVEN	34THSTS&4THAVES	10.1
		12107	34	S	12:00:09	12:00:22	LARGOTRANSITCENTER	LARGOTRANSITCENTER	.2
		12107	34	N	16:57:19	17:26:50	GRANDCENTRALSTATION-I	70THAVE&USHWY19N	29.5
		13106	19	N	05:39:03	06:23:11	HUEYAVE&TARPONAVE	LARGOTRANSITCENTER	44.1
		13108	79	N	11:25:24	11:34:15	66THSTN&PARKBLVD	TYRONESQUAREMALLSHELTER-D	8.9
		13108	79	N	16:19:45	16:27:44	7THAVES&11THSTS	GRANDCENTRALSTATION-C	8.0
		13108	79	N	16:28:11	17:03:39	GRANDCENTRALSTATION-C	TYRONESQUAREMALLSHELTER-A	35.5
		14101	18	S	15:35:44	15:43:40	BAYPINESBLVD&100THWAYN	66THSTN&22NDAVEN	7.9
		14104	59	W	07:33:55	07:43:34	ULMERTONRD&SEMINOLEBLVD	WALSINGHAMRD&137THST	9.7
		14104	59	W	16:58:35	17:07:30	PSTA34THSTLAYBY-PLATFORM-	ULMERTONRD&USHWY19N	8.9
		15106	79	N	15:50:08	15:51:45	49THSTS&9THAVES	49THSTS&NEWTONAVES	1.6
		15106	79	S	16:58:32	17:10:17	58THST&ULMERTONRD	LARGOTRANSITCENTER	11.8
		15106	79	S	17:34:57	18:05:03	58THST&COMMERCECT	TYRONESQUAREMALLSHELTER-D	30.1
		15108	52	N	12:46:29	13:02:07	49THSTN&118THAVEN	PINELLASPARKTRANSITCENTER-SH	15.6
		15108	52	N	15:17:30	15:26:51	62NDSTN&154THAVEN	EASTBAYDR&2NDSTNE	9.4
		15108	52	N	18:13:36	18:53:11	GRANDCENTRALSTATION-B	49THST&LAKEBLVD	39.6
		15108	52	N	21:29:37	21:52:28	PSTA34THSTLAYBY-PLATFORM-	GRANDCENTRALSTATION-B	22.9
		15109	34	N	05:53:26	06:06:35	34THSTN&2NDAVEN	70THAVE&USHWY19N	13.2
		15112	14	W	16:30:12	16:34:42	DRMARTINLUTHERKINGJRSTS&P	18THAVES&16THSTS	4.5
		16103	4	S	19:45:23	20:18:00	3RDSTS&3RDAVES	ROOSEVELTBLVD&16THCTN	32.6
		16103	4	S	21:26:01	21:35:49	4THSTN&62NDAVEN	4THSTN&13THAVEN	9.8
		16104	34	N	15:40:25	15:58:07	34THSTS&46THAVES	GRANDCENTRALSTATION-I	17.7
		16104	34	N	16:21:53	16:34:39	GRANDCENTRALSTATION-I	PINELLASPARKTRANSITCENTER-SH	12.8
		16104	34	S	18:01:17	18:12:42	34THSTN&32NDAVEN	34THSTS&2NDAVES	11.4
		18102	23	E	16:02:26	16:34:04	DRMARTINLUTHERKINGJRSTS&1	TYRONESQUAREMALLSHELTER-B	31.6
		18104	36	E	15:46:50	16:03:11	75THAVE&GULFBLVD	GRANDCENTRALSTATION-E	16.4
		18106	59	E	10:35:31	10:45:57	WALSINGHAMRD&OAKHURSTRDW	ULMERTONRD'U	10.4

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                                              CATS
                    ************************************************           PAGE     2
                                 MULTI-SLOT BICYCLE RACK
                        INDIVIDUAL OBSERVATIONS BY TIME OF DAY REPORT
                                       WEEKDAY
                                AUGUST 2021 - JANUARY 2022
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					BIKE RACK SLOT	BIKE RACK OPEN	BIKE RACK CLOSED	BICYCLE TRIP START LOCATION	BICYCLE TRIP END LOCATION	TRIP TIME (MIN)
DAY OF WEEK	DATE	BUS NO	ROUTE	DIR						
	10/08/21									
		198	47	1	B2	06:38:20	06:52:48	CATS TERMINAL	HIGHLAND RAPHAEL SEMMES - S	14.5
		198	47	1	B1	06:37:53	07:09:42	CATS TERMINAL	BURBANK SBRCA - E	31.8
		198	47	0	B1	07:38:14	07:52:36	GARDERE BURBANK/BAYOU FOU	HIGHLAND S CAMPUS - N	14.4
		198	47	1	B1	08:03:22	08:13:29	HIGHLAND VICARIO - N	CATS TERMINAL	10.1
		198	47	0	B2	09:42:50	09:58:26	HIGHLAND STARING HILL - W	HIGHLAND W. HARDING POLICE S	15.6
		198	47	1	B1	12:20:59	12:55:26	CATS TERMINAL	HIGHLAND PARKER - S	34.5
		198	47	1	B1	14:48:27	15:05:15	HIGHLAND STADIUM - S	BURBANK DR GARDERE LN - E	16.8
		198	47	1	B1	15:05:37	15:11:00	BURBANK DR GARDERE LN - E	BLUEBONNET NORTH OAK HILLS -	5.4
		198	47	1	B2	16:13:48	16:23:08	CATS TERMINAL	CATS TERMINAL	9.3
		198	47	1	B1	16:23:39	16:48:33	CATS TERMINAL	HIGHLAND HIGHLAND VILLAGE SH	24.9
	TOTAL									177.2
	AVG									17.7
	N									10

2.9.11 Productivity Analyses

Route-Level Productivity Ranking

PAGE 1		Capital Area Transit System		DATE 09 Feb 22	

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                    OVERALL ROUTE RIDERSHIP/PRODUCTIVITY RANKING
                              Aug 2021 Schedule
                                  Weekday
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					RANK			RANK
OVERALL		TOTAL		PASS	PASS	ROUTE	LOAD	PASS	PASS
PRODUCTIVITY		DAILY	RIDERSHIP	PER	PER	LOAD	FACTOR	PER	PER
RANKING	ROUTE	RIDERS	RANKING	HOUR	HOUR	FACTOR	RANKING	MILE	MILE
1	41	475	3	21.6	1	.098	2	1.20	1
2	44	851	1	15.8	2	.090	4	1.04	2
3	47	619	2	15.0	3	.111	1	.757	5
4	17	289	5	14.6	4	.095	3	.786	4
5	21	269	6	14.0	5	.088	5	.734	6
6	12	216	8	11.3	8	.082	8	.550	9
8	14	171	12	12.9	6	.061	14	.912	3
8	57	356	4	9.1	12	.084	7	.467	12
9	18	220	7	10.3	9	.072	10	.530	10
10	23	143	14	12.1	7	.064	12	.641	8
11	22	191	9	9.0	13	.075	9	.480	11
12	70	189	10	8.7	15	.087	6	.413	15
13	46	171	11	7.1	16	.068	11	.372	16
15	8	103	17	9.0	14	.042	18	.716	7
15	58	101	18	9.3	11	.061	13	.431	14
16	59	84	19	9.7	10	.059	15	.454	13
17	60	135	15	6.2	17	.049	16	.353	17
18	15	106	16	5.7	18	.042	17	.307	18
19	11	152	13	5.7	19	.031	19	.298	19

Segment-Level Productivity Ranking

SEGMENT NAME	ROUTE	HOURLY PERIODS SAMPLED	DAILY ON	DAILY OFF	DAILY REVENUE HOURS	AVG DIST	AVERAGE BOARDINGS PER HOUR	AVERAGE ON+OFF PER HOUR
CATS – FLORIDAFOSTER	44	17	42	13	1.43	1.59	29.1	37.9
CATS – PLANKCHOCTAW	41	16	47	51	1.79	1.62	26.6	55.9
LEEHIGHLAND – MALLOFLA	47	1	12	2	.58	8.10	20.7	24.2
CATS – EUGENETERRACE	14	16	28	25	1.56	1.21	18.1	34.3
CATS – ELONGTRANSFER	41	15	128	95	6.83	7.43	17.9	31.2
CATS – HIGHLANDVETERANS	47	16	76	73	4.37	3.91	17.5	34.0
CATS – MALLOFLA	17	5	28	5	1.55	7.99	17.4	20.7
CATS – NBONMARCHEHARRY	21	11	93	37	5.93	6.52	16.7	22.9
BURBANKBLUEBONNET – MALLOFLA	47	16	64	8	3.91	3.40	16.5	18.6
CATS – FAIRFIELDSFOSTER	21	17	48	41	3.08	2.85	15.9	29.3
ELONGTRANSFER – PLANKEVANGELINE	41	16	40	36	2.48	2.59	15.7	29.8
CATS – PERKINSCOLLEGE	17	17	62	63	4.16	3.47	15.3	30.2
CORTANAWALMART – FLORIDAFOSTER	44	1	2	0	.13	3.30	15.2	15.2
CATS – CORTANAWALMART	21	10	90	43	6.67	7.33	13.7	20.3
ELONGTRANSFER – PLANKCHOCTAW	41	16	69	19	5.28	5.68	12.5	15.9
HIGHLANDVETERANS – LEEHIGHLAND	47	16	21	22	1.62	1.75	12.4	26.1
CORTANAWALMART – GRNWLSPRGSCRTLND	57	16	69	29	6.33	4.12	11.8	16.8
CATS – MINIDOME	70	6	18	0	1.83	6.63	11.7	11.7
BONCARRE – CORTANAWALMART	44	17	38	35	3.35	2.86	11.6	22.3
MALLOFLA – ONEPERKINSPL	17	17	37	35	3.25	2.75	11.4	22.2
4THSTLAUREL – CATS	44	17	36	66	3.22	2.02	11.1	31.7
ELONGTRANSFER – FOSTERPRESCOTT	23	16	27	23	2.49	1.89	11.0	20.7
CATS – INDEPENDENCEDMV	12	17	38	37	3.87	4.21	10.4	20.0
PLANKCHOCTAW – PLANKEVANGELINE	41	16	16	20	1.55	1.72	10.3	22.6
LATECHCOLLEGE – WOODALECAMELOT	22	15	24	16	2.23	2.77	10.2	17.2
JEFFRSONFLOYNELL – MALLOFLA	60	15	24	2	2.62	2.05	9.6	10.6
FRESHPICKINS – GONEALONEAL	58	10	17	7	1.86	3.67	9.0	12.5
BONCARRE – FLORIDAFOSTER	44	17	21	20	2.37	2.30	8.9	17.2
EUROPESTREET – HOLLYWOODCASINO	22	16	24	5	2.82	1.44	8.7	10.3

2.9.12   Headway Maintenance

Particularly for BRT and Streetcar modes, maintaining consistent headways (time between vehicles) is an important service quality feature.

UTA's APC Software package includes a Headway Maintenance set of reports that present the Schedule Deviation of each vehicle at each Timepoint (Station) for a given Route (service). If a Scheduled Headway is set at 15 minutes, riders expect service to arrive at a given location every 15 minutes. The magnitude of difference between Scheduled Headways and Actual Headways will identify times/locations when transit service is not meeting the Scheduled Headways.

The report below is from the Sonoma-Marin Rail Transit District (SMART) which presents one (1) page summary of all Trips in a given Direction on a given Date.

HEADWAY MAINTENANCE REPORT
09/08/22

TRIP	CAR 1	CAR 2	ACTUAL DEPART TIME	SCHED RUN TIME	ACTUAL RUN TIME	ACTUAL DEPART SCHDEV	TP1 NAME	TP2 SCHDEV	TP2 NAME	TP3 SCHDEV	TP3 NAME	TP4 SCHDEV	TP4 NAME	TP5 SCHDEV	TP5 NAME	TP6 SCHDEV	TP6 NAME	TP7 SCHDEV	TP7 NAME	TP8 SCHDEV	TP8 NAME	TP9 SCHDEV	TP9 NAME	TP10 SCHDEV	TP10 NAME	TP11 SCHDEV	TP11 NAME	TP12 SCHDEV	TP12 NAME
4:39	107	110	4:39:01	79	77.9	0.02	SONOMACO	-0.05	SANTAROS	0.12	SANTAROS	-0.02	ROHNERTP	1.1	COTATI	0	PETALUMA	-0.45	NOVATOSA	-0.02	NOVATODO	-0.1	NOVATOHA	0.23	MARINCIV	-0.15	SANRAFAE	-1.1	LARKSPUR
5:02	101	102	5:01:54	79	78.1	-0.1	SONOMACO	-0.03	SANTAROS	-0.13	SANTAROS	-0.25	ROHNERTP	0.67	COTATI	-0.07	PETALUMA	-0.08	NOVATOSA	-0.03	NOVATODO	-0.12	NOVATOHA	0.28	MARINCIV	-0.07	SANRAFAE	-1.05	LARKSPUR
6:06	105	106	6:06:17	79	80.8	0.28	SONOMACO	-0.15	SANTAROS	0.33	SANTAROS	0.53	ROHNERTP	0.97	COTATI	-0.28	PETALUMA	3.82	NOVATOSA	3.75	NOVATODO	3.23	NOVATOHA	3.32	MARINCIV	2.97	SANRAFAE	2.13	LARKSPUR
6:38	103	104	6:37:50	79	79.8	-0.17	SONOMACO	-0.92	SANTAROS	-0.17	SANTAROS	-0.28	ROHNERTP	1.18	COTATI	0.17	PETALUMA	4.23	NOVATOSA	4.22	NOVATODO	1.92	NOVATOHA	2.12	MARINCIV	1.57	SANRAFAE	0.68	LARKSPUR
7:10	115	116	7:10:13	79	78.6	0.22	SONOMACO	0.23	SANTAROS	0.33	SANTAROS	0.17	ROHNERTP	1.98	COTATI	-0.33	PETALUMA	0.3	NOVATOSA	0.67	NOVATODO	0.52	NOVATOHA	0.9	MARINCIV	0.73	SANRAFAE	-0.18	LARKSPUR
7:42	107	110	7:27:36	79	86.3	-14.4	SONOMACO	0.17	SANTAROS	0.7	SANTAROS	0.63	ROHNERTP	1.45	COTATI	0.28	PETALUMA	1.55	NOVATOSA	1.6	NOVATODO	1.27	NOVATOHA	1.42	MARINCIV	1.3	SANRAFAE	0.18	LARKSPUR
8:14	101	102	8:13:56	79	79.2	-0.07	SONOMACO	-0.12	SANTAROS	-0.18	SANTAROS	-0.43	ROHNERTP	0.55	COTATI	-0.13	PETALUMA	2.2	NOVATOSA	2.17	NOVATODO	1.57	NOVATOHA	1.65	MARINCIV	1.05	SANRAFAE	0.12	LARKSPUR
9:18	105	106	9:18:14	79	78.1	0.23	SONOMACO	-0.32	SANTAROS	-0.48	SANTAROS	-0.07	ROHNERTP	0.88	COTATI	-0.62	PETALUMA	0.85	NOVATOSA	0.8	NOVATODO	0.12	NOVATOHA	0.38	MARINCIV	-0.13	SANRAFAE	-0.63	LARKSPUR
12:45	105	106	12:44:49	79	77	-0.18	SONOMACO	6.5	SANTAROS	6.1	SANTAROS	5.58	ROHNERTP	5.62	COTATI	1.88	PETALUMA	1.42	NOVATOSA	1.25	NOVATODO	-0.1	NOVATOHA	0	MARINCIV	-0.58	SANRAFAE	-2.15	LARKSPUR
13:17	107	110	13:16:48	79	78.2	-0.2	SONOMACO	-0.47	SANTAROS	-0.3	SANTAROS	-0.4	ROHNERTP	0.3	COTATI	-0.42	PETALUMA	0.28	NOVATOSA	0.52	NOVATODO	-0.33	NOVATOHA	0.4	MARINCIV	0.05	SANRAFAE	-1.03	LARKSPUR
14:21	101	102	14:21:01	79	79.5	0.02	SONOMACO	0.12	SANTAROS	0.35	SANTAROS	0.9	ROHNERTP	2.15	COTATI	-0.3	PETALUMA	2.62	NOVATOSA	2.67	NOVATODO	2.35	NOVATOHA	2.57	MARINCIV	2.12	SANRAFAE	0.53	LARKSPUR
14:53	115	116	14:53:22	79	78.1	0.37	SONOMACO	0.08	SANTAROS	0	SANTAROS	0.25	ROHNERTP	1.63	COTATI	0.97	PETALUMA	3.4	NOVATOSA	3.23	NOVATODO	1.17	NOVATOHA	1.27	MARINCIV	0.92	SANRAFAE	-0.48	LARKSPUR
15:25	103	104	15:25:01	79	77.4	0.02	SONOMACO	-0.2	SANTAROS	0.38	SANTAROS	0.42	ROHNERTP	1.82	COTATI	-0.2	PETALUMA	-0.22	NOVATOSA	0.15	NOVATODO	-0.12	NOVATOHA	0.27	MARINCIV	0.12	SANRAFAE	-1.57	LARKSPUR
15:57	105	106	15:56:32	79	78.5	-0.47	SONOMACO	-0.45	SANTAROS	0.1	SANTAROS	-0.05	ROHNERTP	0.38	COTATI	-0.18	PETALUMA	1.87	NOVATOSA	1.7	NOVATODO	1.22	NOVATOHA	1.2	MARINCIV	0.62	SANRAFAE	-0.98	LARKSPUR
17:01	107	110	16:59:49	79	83.8	-1.18	SONOMACO	-0.05	SANTAROS	0.43	SANTAROS	2.17	ROHNERTP	6.72	COTATI	5.7	PETALUMA	5.48	NOVATOSA	5.58	NOVATODO	5.45	NOVATOHA	5.77	MARINCIV	5.4	SANRAFAE	4.23	LARKSPUR
17:33	101	102	17:33:28	79	87.4	0.47	SONOMACO	1.7	SANTAROS	1.63	SANTAROS	13.42	ROHNERTP	13.73	COTATI	10.57	PETALUMA	11.82	NOVATOSA	11.73	NOVATODO	10.9	NOVATOHA	10.78	MARINCIV	10.5	SANRAFAE	8.83	LARKSPUR
18:05	115	116	18:05:00	79	90.3	0	SONOMACO	0.62	SANTAROS	2.63	SANTAROS	14.42	ROHNERTP	14.73	COTATI	14.48	PETALUMA	14.38	NOVATOSA	14.22	NOVATODO	13.63	NOVATOHA	13.43	MARINCIV	12.87	SANRAFAE	11.25	LARKSPUR
18:37	103	104	18:37:03	79	95	0.05	SONOMACO	0.13	SANTAROS	0.07	SANTAROS	23.95	ROHNERTP	24.05	COTATI	20.27	PETALUMA	21.18	NOVATOSA	20.98	NOVATODO	18.8	NOVATOHA	18.55	MARINCIV	17.52	SANRAFAE	16.05	LARKSPUR

2.9.13   Intermodal Transfer Analysis

An effective transit system allows riders to conveniently transfer between modes. Bus to Rail and Rail to Bus transfers executed well encourage riders to utilize the modes of transit in an efficient manner.

<table>
<tr><td colspan="18">SACRT RAIL TO BUS - OUTBOUND TRANSFER ANALYSIS
29 ST STATION
AUG 2019 - WEEKDAY</td></tr>
<tr><th>STATION</th><th>MODAL TRANSFER</th><th>DATE</th><th>MODE</th><th>RAIL STATION</th><th>VEHNO</th><th>SCHEDULE TIME</th><th>ARRIVAL TIME</th><th>DEPARTURE TIME</th><th>MODE</th><th>VEHNO</th><th>ARRIVAL TIME</th><th>DEPARTURE TIME</th><th>SCHEDULE TIME</th><th>DIFFERENCE (MIN)</th><th>WAITING STATUS</th></tr>
<tr><td>29ST</td><td>RAIL-TO-BUS OUTBOUND</td><td>8/5/2019</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>120</td><td>6:50</td><td>6:50:59</td><td>6:52:11</td><td>BUS</td><td>1502</td><td>6:51:50</td><td>6:51:50</td><td>6:48</td><td>0.85</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>222</td><td>10:05</td><td>10:06:03</td><td>10:07:19</td><td>BUS</td><td>2861</td><td>10:19:38</td><td>10:19:38</td><td>10:18</td><td>13.58</td><td>REASONABLE</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>202</td><td>11:50</td><td>11:50:56</td><td>11:52:14</td><td>BUS</td><td>1566</td><td>11:54:37</td><td>11:54:37</td><td>11:48</td><td>3.68</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>232</td><td>13:05</td><td>13:06:46</td><td>13:07:58</td><td>BUS</td><td>1514</td><td>13:20:47</td><td>13:20:47</td><td>13:18</td><td>14.02</td><td>REASONABLE</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>202</td><td>13:35</td><td>13:37:19</td><td>13:38:28</td><td>BUS</td><td>1527</td><td>13:50:08</td><td>13:50:08</td><td>13:48</td><td>12.82</td><td>REASONABLE</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>215</td><td>15:20</td><td>15:21:54</td><td>15:23:07</td><td>BUS</td><td>1512</td><td>15:22:37</td><td>15:22:37</td><td>15:18</td><td>0.72</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>210</td><td>15:35</td><td>15:35:56</td><td>15:37:.0</td><td>BUS</td><td>1502</td><td>15:53:56</td><td>15:53:56</td><td>15:48</td><td>18</td><td>EXCESSIVE</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>211</td><td>18:05</td><td>18:09:30</td><td>18:10:36</td><td>BUS</td><td>1527</td><td>18:20:28</td><td>18:20:28</td><td>18:18</td><td>10.97</td><td>REASONABLE</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>116</td><td>19:05</td><td>19:04:28</td><td>19:05:25</td><td>BUS</td><td>1570</td><td>19:05:47</td><td>19:05:47</td><td>19:07</td><td>1.32</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>202</td><td>20:05</td><td>20:09:31</td><td>20:10:37</td><td>BUS</td><td>1512</td><td>20:12:02</td><td>20:12:02</td><td>20:07</td><td>2.52</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>209</td><td>21:05</td><td>21:05:02</td><td>21:06:35</td><td>BUS</td><td>1566</td><td>21:09:33</td><td>21:09:33</td><td>21:07</td><td>4.52</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td>RAIL</td><td>16ST</td><td>218</td><td>22:05</td><td>22:06:06</td><td>22:07:08</td><td>BUS</td><td>1538</td><td>22:08:06</td><td>22:08:06</td><td>22:07</td><td>2</td><td>MINIMUM</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>AVG</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>7.08</td><td></td></tr>
<tr><td></td><td></td><td>OBS</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>12</td><td></td></tr>
</table>

2.9.14   Actual vs Scheduled EOL Dwell Times

The Actual vs Scheduled EOL Dwell Times report provides a magnitude of difference in actual time and scheduled time at the EOL layover. This report is often utilized to confirm verbal anecdotal comments relative to sufficient time for recovery.

Often, drivers arrive Early and Depart Late which may add a significant number of minutes of the transit vehicle being idle.

This report also illustrates cases, typically in bad weather, when the drivers take less recovery time in order to get back on schedule.

DAY	ROUTE	LOCATION	SCHEDULE DEPART TIME	BLOCK	VEHICLE NO.	DATE	DELTA (FEET)	ACTUAL ARRIVAL TIME	SCHEDULE	ACTUAL DEPARTURE TIME	SCHEDULE DEPARTURE TIME	ARRIVAL SCH DEV	DEPARTURE SCH DEV	NET DIFFERENCE	SCHED DWELL TIME	ACTUAL DWELL TIME
WKD	2	ITC	05:45	64714	1861	2/5/2019	1/28/1900	5:34:11	5:45:00	5:45	5:45:00	-10.82	0.77	11.59	0.00	11.58
				64714	1861	2/8/2019	1/29/1900	5:34:22	5:45:00	5:46	5:45:00	-10.63	1.33	11.96	0.00	11.97
				64714	1861	2/11/2019	1/31/1900	5:34:54	5:45:00	5:45	5:45:00	-10.1	0.57	10.67	0.00	10.67
				64714	1861	2/12/2019	2/10/1900	5:34:18	5:45:00	5:44	5:45:00	-10.7	-0.35	10.35	0.00	10.35
				64714	1861	2/13/2019	2/4/1900	5:37:09	5:45:00	5:45	5:45:00	-7.85	0.12	7.97	0.00	7.97
				64714	1861	2/14/2019	1/24/1900	5:36:40	5:45:00	5:46	5:45:00	-8.33	1.55	9.88	0.00	9.88
				64714	1865	2/15/2019	1/28/1900	5:35:09	5:45:00	5:46	5:45:00	-9.85	1.27	11.12	0.00	11.12
				64714	1861	2/18/2019	1/22/1900	5:34:59	5:45:00	5:45	5:45:00	-10.02	0.22	10.24	0.00	10.23
				64714	1861	2/20/2019	1/28/1900	5:41:44	5:45:00	5:47	5:45:00	-3.27	2.33	5.6	0.00	5.6
				64714	1861	2/21/2019	1/28/1900	5:35:12	5:45:00	5:46	5:45:00	-9.8	1.22	11.02	0.00	11.02
				64714	1864	2/22/2019	1/29/1900	5:35:56	5:45:00	5:47	5:45:00	-9.07	2.03	11.1	0.00	11.1
				64714	1861	2/25/2019	1/27/1900	5:36:23	5:45:00	5:45	5:45:00	-8.62	0.37	8.99	0.00	8.98
				64714	1862	2/26/2019	2/6/1900	5:40:21	5:45:00	5:44	5:45:00	-4.65	-0.28	4.37	0.00	4.37
				64714	1861	2/27/2019	1/29/1900	5:37:33	5:45:00	5:45	5:45:00	-7.45	0.45	7.9	0.00	7.9
				64714	1866	2/28/2019	1/23/1900	5:35:05	5:45:00	5:47	5:45:00	-9.92	2.37	12.29	0.00	12.28
				64714	1866	3/1/2019	1/21/1900	5:33:34	5:45:00	5:50	5:45:00	-11.43	5.57	17	0.00	17
				64714	1863	3/4/2019	1/13/1900	5:32:52	5:45:00	5:45	5:45:00	-15.42	0.15	15.57	0.00	12.28
				64714	1864	3/5/2019	1/29/1900	5:42:17	5:45:00	5:46	5:45:00	-2.72	1.07	3.79	0.00	3.78
				64714	1861	3/6/2019	1/28/1900	5:34:23	5:45:00	5:38	5:45:00	-10.62	-6.13	4.49	0.00	4.48
				64714	1863	3/7/2019	1/9/1900	5:34:15	5:45:00	5:45	5:45:00	-10.75	0.67	11.42	0.00	11.42
				64714	1863	3/8/2019	1/11/1900	5:34:12	5:45:00	5:45	5:45:00	-10.8	0.95	11.75	0.00	11.75
		AVG						-9.18		0.77		9.95	0	9.8		

2.9.15 Deadhead Running Time

At a number of transit agencies, UTA has found that the potential savings due to excess Deadhead Running Times may exceed the cost of the APC system. In other words, APC-generated Deadhead Running Times may identify significant savings.

Also, the Variation in Distance of the Deadhead Trip is an indication of consistency in the route/path the bus followed in executing the Deadhead Trip. Users have utilized the Deadhead Report to identify the best Deadhead route/path when Deadhead routing had not been previously defined.

Deadhead Running Time analyses require a schedule export that contains Deadhead Trips. GTFS exports typically do not contain Deadhead Trips.

HART
DEADHEAD RUNNING TIME – PULL-IN
INDIVIDUAL OBSERVATIONS
Aug 2021 Schedule
DIRECTION PULL-IN

DAY OF WEEK	SEGMENT	BLOCK	BUS NO	DATE	DEPART TIME	SCHED TIME	SCHED DEVTN	RUN TIME (MIN)	SCHED RUN TIME	DIST (MLS)	TIME DIFF	LOWER LIMIT	UPPER LIMIT
WEEKDAY	BP – GARAGE	17362	1967	8/27/2021	22:44:41	23:01	-16.3	8.9	23	8	-14	7	16.5
			1714	9/2/2021	22:42:52	23:01	-18.1	9.1	23	7.2	-14	7	16.5
			1211	9/15/2021	22:42:27	23:01	-18.6	8.1	23	7.5	-15	7	16.5
			1967	9/22/2021	22:45:39	23:01	-15.4	8.1	23	8	-15	7	16.5
			1968	10/8/2021	22:44:11	23:01	-16.8	9.8	23	8.6	-13	7	16.5
			1606	10/11/2021	22:44:15	23:01	-16.8	8.2	23	7.9	-15	7	16.5
			1209	10/15/2021	22:42:19	23:01	-18.7	8	23	7.6	-15	7	16.5
			1609	10/26/2021	22:46:46	23:01	-14.2	10.8	23	7.9	-12	7	16.5
			1210	11/9/2021	22:42:29	23:01	-18.5	8.7	23	7.1	-14	7	16.5
			1969	11/12/2021	22:43:46	23:01	-17.2	8.8	23	8.1	-14	7	16.5
			1702	11/16/2021	22:48:50	23:01	-12.2	12.8	23	7.4	-10	7	16.5
			1204	11/23/2021	22:49:46	23:01	-11.2	9.4	23	7.4	-14	7	16.5
			1716	1/13/2022	22:45:09	23:01	-15.9	11.2	23	7	-12	7	16.5
		AVG						9.4	23	7.7	-14		
		STDEV						1.4	0	0.5	1.4		

DAY OF WEEK	SEGMENT	BLOCK	BUS NO	DATE	DEPART TIME	SCHED TIME	SCHED DEVTN	RUN TIME (MIN)	SCHED RUN TIME	DIST (MLS)	TIME DIFF	LOWER LIMIT	UPPER LIMIT
WEEKDAY	GARAGE - AMZN	3104	1713	8/24/2021	5:33:59	5:30	3.4	45.6	43	28.8	2.6	33.7	55.6
			1720	8/30/2021	5:32:51	5:30	2.85	43.5	43	28.3	0.5	33.7	55.6
			1519	8/31/2021	5:38:41	5:30	7.83	47	43	28.9	4	33.7	55.6
			1711	9/1/2021	5:18:52	5:30	-11.1	.	43	26.1	.	33.7	55.6
			1711	9/2/2021	5:25:05	5:30	-4.92	.	43	24.6	.	33.7	55.6
			1711	9/7/2021	5:34:27	5:30	4.02	47.5	43	29.2	4.5	33.7	55.6
			1969	9/13/2021	5:32:30	5:30	-12.7	.	43	29	.	33.7	55.6
			1701	10/29/2021	5:37:11	5:30	5.8	45.1	43	29.6	2.1	33.7	55.6
			1515	11/1/2021	5:36:41	5:30	5.75	43.9	43	28.9	0.9	33.7	55.6
			1967	11/4/2021	5:36:32	5:30	5.9	49.2	43	30.9	6.2	33.7	55.6
			1711	11/10/2021	5:37:38	5:30	5.63	49	43	28.7	6	33.7	55.6
			1704	11/12/2021	5:38:02	5:30	7.08	42.4	43	29	-0.6	33.7	55.6
			1714	11/16/2021	5:36:57	5:30	5.27	36.3	43	27	-6.7	33.7	55.6
			1967	11/17/2021	5:35:35	5:30	4.75	38.7	43	31	-4.3	33.7	55.6
			1518	11/22/2021	5:40:09	5:30	9.32	48.8	43	29.1	5.8	33.7	55.6
			1601	11/23/2021	5:32:34	5:30	-0.22	42	43	28.2	-1	33.7	55.6
			1969	11/24/2021	5:28:31	5:30	-2.4	40.7	43	30.9	-2.3	33.7	55.6
			1202	11/26/2021	5:32:24	5:30	-2.25	35.8	43	27.9	-7.2	33.7	55.6
			1612	12/2/2021	5:34:01	5:30	1.02	40.4	43	28.1	-2.6	33.7	55.6
			1607	12/7/2021	5:33:57	5:30	3.95	39.4	43	29.8	-3.6	33.7	55.6
			1609	12/10/2021	5:39:37	5:30	8.12	43.4	43	30.1	0.4	33.7	55.6
			1701	12/13/2021	5:35:42	5:30	5.7	46.4	43	28.7	3.4	33.7	55.6
			1607	12/14/2021	5:32:47	5:30	2.78	40.8	43	29.4	-2.2	33.7	55.6
			1711	12/16/2021	5:21:34	5:30	-8.43	.	43	28.2	.	33.7	55.6
			1718	12/20/2021	5:38:24	5:30	8.4	44.8	43	28.5	1.8	33.7	55.6
			1520	12/22/2021	5:37:19	5:30	7.17	43.9	43	28.9	0.9	33.7	55.6
			1711	12/23/2021	5:39:00	5:30	8.83	48.2	43	28.8	5.2	33.7	55.6
			1610	12/27/2021	5:40:38	5:30	10.05	45.6	43	28.7	2.6	33.7	55.6
			1714	12/29/2021	5:37:11	5:30	7.18	49.1	43	28.8	6.1	33.7	55.6
			1968	12/30/2021	5:37:11	5:30	4.27	47.7	43	30.9	4.7	33.7	55.6
			1608	12/31/2021	5:39:33	5:30	9.32	55.2	43	28.8	12.2	33.7	55.6
			1701	1/4/2022	5:34:50	5:30	4.17	45.2	43	27.3	2.2	33.7	55.6
			1709	1/5/2022	5:36:43	5:30	3.92	54	43	28.2	11	33.7	55.6
			1609	1/18/2022	5:40:25	5:30	9.43	43.5	43	29.2	0.5	33.7	55.6
			1701	1/19/2022	5:39:02	5:30	8.75	49.7	43	29.4	6.7	33.7	55.6
			AVG					45.8	43	29	2.8		
			STDEV					4.5	0	1.2	4.5		

```
                                HART
                        DEADHEAD RUNNING TIME
                        ANNUALIZED SUMMARY REPORT
                          Aug 2021 Schedule
                           DATE: 8 Feb 22
                         WEEKDAYS=256 PER YEAR
                         SATURDAYS=52 PER YEAR
                         SUNDAYS=57 PER YEAR
```

DAY	DIRECTION	OLD TIMEPOINT	NEW TIMEPOINT	SAMPLES	AVG DIST	ST DEV DIST	AVERAGE ACTUAL RUN TIME	MEDIAN ACTUAL RUN TIME	SCHEDULE RUNNING TIME	DIFFERENCE (MIN)	TOTAL DAILY DEADHEAD TRIPS	NET ANNUAL HOURS
WKD	PULL OUT	GARAGE	AMZN	87	29	1.26	45.5	45.7	43	-2.5	2	-21
		GARAGE	BP	153	8.6	1.06	16.8	15.4	25	8.2	4	141
		GARAGE	CUBL	77	16.7	0.83	36.3	35.8	42	5.7	3	73
		GARAGE	FHSP	66	24.9	1.19	38.3	37.6	42	3.7	3	47
		GARAGE	FLDM	29	12.8	0.61	22.2	21.6	26	3.8	1	16
		GARAGE	FLEORAE	34	13.2	0.88	24.7	24.4	30	5.3	1	23
		GARAGE	FLFL	31	10.7	1.82	23.1	15.6	43	19.9	1	85
		GARAGE	HAPR	22	11.7	2.29	27.5	26.2	25	-2.5	2	-21
		GARAGE	MDLO	102	13.2	0.98	39.6	38.9	35	-4.6	6	-117
		GARAGE	MTC	704	3.75	0.53	9.2	8.9	10	0.8	23	77
		GARAGE	NTPK	549	2.5	0.46	8.7	8.1	9	0.3	16	23
		GARAGE	NWTC	217	15.3	1.02	28.4	27.2	33	4.6	7	138
		GARAGE	UATC	783	7.54	0.4	19.9	19	22	2.1	25	226
		GARAGE	WB	134	11.1	0.76	23.2	22.4	30	6.8	5	146
		GARAGE	WP	34	7.83	0.43	15	14.4	17	2	1	9
		GARAGE	YUKON	216	7.57	0.76	16.2	15.2	19	2.8	5	59
TOTAL				3238	196		394		451		105	903

An effective method for improving On-Time Performance is to generate the Schedule Adherence Consistency analysis which identifies the times/locations when/where transit service is consistently Early, On-Time, and Late.

For times/locations where service is consistently Early or Late, adjustments to the schedule and/or redirection of on-street supervision will change the consistently Early or Late observations to On-Time.

For times/locations where service is consistently On-Time, positive recognition both internal and external to the organization can be provided in recognition of the high-quality service being provided.

For times/locations where On-Time Performance varies greatly, collaboration between the transit organization and local traffic engineering can focus on the potential of options such as parking restrictions, signal timing, turn lanes, etc. in improving the consistency of service.

								LAST				
		TIME	TIME				ARRIVAL	DOOR	DEPART	SCHEDULE	SCHEDULE	
ROUTE	DIR	PERIOD	POINT	BLOCK	DATE	VEHNO	TIME	TIME	TIME	TIME	DEVIATION	STATUS
1	0							CLOSE				
		8:30 AM	UATC									
		8:45 AM										
				102	2/21/2022	1612	8:11:30	8:30:12	8:30:46	8:30	0.77	ON TIME
				102	2/25/2022	1720	8:18:00	8:29:49	8:31:16	8:30	1.27	ON TIME
				102	3/2/2022	1610	8:20:26	8:30:01	8:30:45	8:30	0.75	ON TIME
				102	3/3/2022	2139	8:29:21	8:30:18	8:30:49	8:30	0.82	ON TIME
				102	3/4/2022	2138	8:21:36	8:30:21	8:30:53	8:30	0.88	ON TIME
				102	3/7/2022	1607	8:14:26	8:29:26	8:30:11	8:30	0.18	ON TIME
				102	3/9/2022	2134	8:14:31	8:30:27	8:30:58	8:30	0.97	ON TIME
				102	3/10/2022	1212	8:13:51	8:31:49	8:32:28	8:30	2.47	ON TIME
				102	3/23/2022	1967	8:28:53	8:30:32	8:30:57	8:30	0.95	ON TIME
				102	4/5/2022	1302	8:19:03	8:30:07	8:30:49	8:30	0.82	ON TIME
				102	4/6/2022	1601	8:25:43	8:29:29	8:30:36	8:30	0.6	ON TIME
				102	4/8/2022	2141	8:17:12	8:30:27	8:30:58	8:30	0.97	ON TIME
				102	4/12/2022	1517	8:20:26	8:30:35	8:31:38	8:30	1.63	ON TIME
				102	4/13/2022	1603	8:12:55	8:29:53	8:30:32	8:30	0.53	ON TIME
				102	4/18/2022	1606	8:16:56	8:30:19	8:30:52	8:30	0.87	ON TIME
				102	4/25/2022	1211	8:17:14	8:34:47	8:35:29	8:30	5.48	LATE
				102	4/26/2022	1707	8:17:58	8:30:34	8:31:08	8:30	1.13	ON TIME
				102	4/27/2022	1520	8:15:04	8:30:45	8:31:31	8:30	1.52	ON TIME
				102	4/29/2022	2137	8:14:57	8:30:01	8:30:32	8:30	0.53	ON TIME
				102	5/2/2022	1610	8:31:07	8:31:58	8:32:09	8:30	2.15	ON TIME
				102	5/4/2022	1964	8:16:45	8:31:15	8:31:41	8:30	1.68	ON TIME
				102	5/16/2022	2132	8:17:37	8:29:52	8:30:23	8:30	0.38	ON TIME
				102	5/20/2022	1701	8:21:02	8:30:21	8:31:07	8:30	1.12	ON TIME
				102	6/3/2022	2145	8:15:19	8:28:08	8:29:43	8:30	-0.28	ON TIME
				102	6/6/2022	1515	8:17:07	8:29:45	8:30:22	8:30	0.37	ON TIME
				102	6/7/2022	1302	8:15:03	8:29:43	8:30:52	8:30	0.87	ON TIME
				102	6/8/2022	1613	8:12:12	8:29:55	8:30:31	8:30	0.52	ON TIME
				102	6/10/2022	1606	8:17:10	8:29:52	8:31:08	8:30	1.13	ON TIME
				102	6/13/2022	1606	8:17:17	8:27:43	8:30:35	8:30	0.58	ON TIME
				102	6/15/2022	1609	8:17:12	8:30:00	8:30:48	8:30	0.8	ON TIME
				102	6/17/2022	1603	8:12:13	8:29:03	8:30:49	8:30	0.82	ON TIME
			TP AVG								1.07	
		AVG									0.98	
	AVG										1.07	
AVG											1.07	
											0.73	

HART
SCHEDULE ADHERENCE REPORT
INDIVIDUAL OBSERVATIONS - CONSISTENTLY ONTIME
Weekday
May 2022 Schedule
On-Time = Between 0.5 Min Before Sched Time and 5.0 Min After Sched Time

2.9.16 Summary of Reports/Plots

Presented below is a summary of the wide range of analytic reports within UTA's APC Software package:

	Reports
	Standard Analytical Reports
1	Ride-check Report
2	Bus Stop: Individual Stop Observations
3	Bus Stop: Daily Ridership Summary by Unique Stop
4	Bus Stop: Load Plot by Stop by Trip
5	Segment Report: Individual Segment Observations
6	Segment Report: Ridership
7	Segment Report: Running Time
8	Segment Report: Max Load
9	Segment Report: Velocity
10	Actual Vs. Scheduled Running Time Plots
11	Trip Report: Individual Observations
12	Trip Report: Summary
13	Trip Report: Ridership/Max Load Plot
14	Trip Report: Route Demand by Direction Plot
15	Trip Report: Route Demand Plot
16	Route Ridership: Route Level Daily Ridership
17	Route Ridership: System Ridership/Trip Length
18	Schedule Adherence: System Totals by Day of Week
19	Schedule Adherence: Time Period Summary
20	Schedule Adherence: Time Point Summary
21	Schedule Adherence: Individual Observations
22	Deadhead Running Time: Individual Observations
23	Deadhead Running Time: Summary by Origin-Destination
24	NTD Reports/Substantiation: Route Summaries
25	NTD Reports/Substantiation: Trip Summary
26	NTD Reports/Substantiation: Individual Trip Observations
27	NTD Reports/Substantiation: Selection of Random Trip Samples
28	Schedule Adherence Consistency
29	Exception Report – Consistent Times/Locations
30	Exception Report – Inconsistent Times/Locations
31	Peak/30 Min Off-Peak Summaries
	Productivity Reports
32	Stop Ridership Ranking Report
33	Stop Productivity Ranking Report
34	Trip Productivity Analysis
35	Exception Report – Low Productivity Trips
36	Exception Report – Overcrowded Trips
37	Route Productivity Ranking

38	Ridership, Passengers/Mile, Passengers/Hour, Passenger Miles
39	Bi-Directional Segment Productivity
40	Daily Totals Report
41	Daily Totals Hourly Summaries
42	Garage Schedule Adherence
43	Wheelchair Lift Usage Report
44	Paired Origin-Destination Observation
45	Frequency Plot by Hour
46	Frequency Plot by Route
47	Municipal Service Utilization Report
48	System Summary – Miles, Hours, Ridership
49	Route Summary – Miles, Hours, Ridership
50	Block Productivity Report
51	EOL Dwell Time Report
52	Scheduled Vs. Actual Individual Observations
53	Scheduled Vs. Actual Summary
54	Headway Maintenance Report
55	Headway Determination Report
56	Multi Markup (Signup) Productivity Analysis by Route
57	Multi Markup (Signup) Productivity Analysis by Time Period
58	Census Tract/ TAZ Productivity Reports
	Administrative Control Reports
59	APC Sampling Status: Trip Sampled Per Route Summary Table
60	APC Sampling Status: Un-Sampled Blocks Report
61	APC Sampling Status: Hourly Sampled/Scheduled Plot
62	APC Deployment Plan: Daily Blocks Per Division Per Bus Type
63	APC Diagnostics: Daily Totals – Last Seven (7) Days
64	APC Diagnostics: Anomaly Report
65	APC Diagnostics: Exception Reporting
66	Bus Stop Geo-Coding Accuracy/Comprehensiveness
67	Summary Exception Report by Non-Compliant Bus Stop
68	Individual Observations
69	Reference File Comparison: Trips/Stops/Time-Points by Route-Dir-Pattern.
70	Reference File Comparison: Trips/Stops/Time-Points by Schedule-Route-Dir-Pattern.
71	Trip Start of Line/End of Line Matching: Summary by Route
72	Trip Start of Line/End of Line Matching: Individual Obser,
73	Trip Start of Line/End of Line Matching: First & Last Trip
74	Time Point Segment Contiguity
75	Schedule Adherence Complaint Validation
76	APC System Performance/Trend (Data Yield Analysis)
77	Next Day Impact Analysis

2.9.17   Global Reporting

UTA will execute the Global Reporting software module on a regular (monthly, schedule or quarter period) basis. Global Reporting generates standard UTA reports for all Routes on Weekdays, Saturdays, and Sundays. Global Reports generate reports and plots in standard formats (.xlsx, .csv, .jpg, .kml, etc.) which can be specified by the City of Columbia. The Global Reports will be stored in a password protected FTP or AWS bucket available for instant download by local staff. Global Reports eliminate the need for staff to actively generate analytics on historical data.

See sample screenshots below:
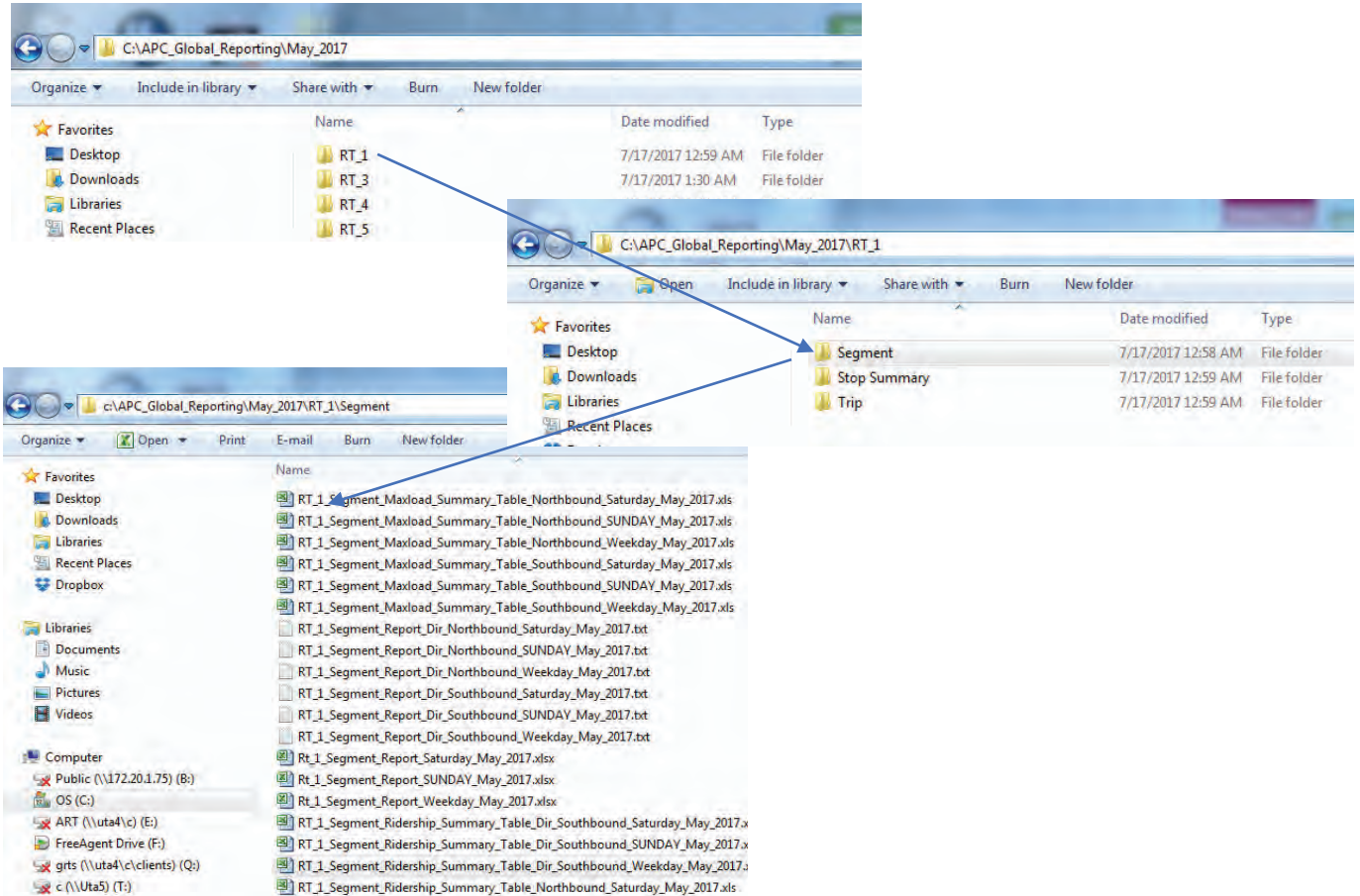
2.9.18 Examples of Ad-Hoc User Requested Analytics

Next Day Ridership

The Next Day Ridership Reporting is an optional feature which affords transit managers quick feedback from planning and operations about their ridership from previous day. This feedback is extremely critical not only from operations and planning point but also from political, media and marketing perspective. However, we all know how difficult it is to provide accurate Next Day ridership early in the day to make day to day adaptions in operations and scheduling.

Challenges such as data transfer, differences between scheduled and operational service, detours, missed service, extra service, make it even more difficult to accurately estimate ridership next day.

UTA has been providing Next Day Ridership using an approach that presents individual APC trip observations, then 'backfills' average APC data for any trip data that may not have been collected on the single date due to the challenges listed above. Unsampled trips average ridership is derived from the sample of the same trip data from the preceding day, week, or month.

An excerpt from a Next Day Ridership Report from Delaware DelDot is below:

Special Event Ridership

HART Streetcar Gasparilla Festival Ridership – On 01/29/22, Tampa held a downtown event entitled Gasparilla Festival during which HART's Streetcar service was heavily utilized. Each HART Streetcar is equipped with an APC system. On Monday, 01/31/22, UTA provided Gasparilla Ridership on HART's Streetcar Service.

2.9.19   APC Political Jurisdiction Reports

UTA's Political Jurisdiction reports provide the Ridership, Passenger Miles, Revenue Miles and Revenue Hours for a wide range of political jurisdictions served by a transit agency (census tracts, cities, counties, commissioner districts, traffic zones, etc.). With census tracts, socio-economic variables can be incorporated into the Political Jurisdiction reports that provide information to meet Title VI reporting along with assessing Ridership changes by demographic groupings. also offer easy export JPG graphs which can be used in presentation as well as standard UTA Analytic Reporting features of immediate export of data to CSV files and Macro- to Micro- drill down analytics.

The example below is a Political Jurisdiction Report by Census Tract in which APC observations are assigned to a Census Tract. Once the Census Tract is matched, socioeconomic variables such as Median Income can be included in the report.

Given the presence of Lat/Long and Time of Day on each Boarding and Alighting observation from buses and Streetcars, UTA's APC Software can apply a variety of Political Jurisdictions to each APC record. Political Jurisdictions can include: city, county, census tract, commissioner district, traffic zone, zip code, etc. With census tracts, a wide range of socioeconomic variables can be added to the analysis.

Providing periodic summaries by Political Jurisdiction will allow the transit staff and the various communities served by the transit agency to review the amount of service provided and the amount of service utilized.

With census tracts, a wide range of socioeconomic variables can be added to the analyses. Presented below is an example from Sacramento that compared the changes in Ridership by Median Income over two (2) chronological periods.

DAY OF WEEK	TIME PERIOD	CENSUS TRACT	MEDIAN INCOME	AVERAGE DAILY Dec-20 RIDERS	AVERAGE DAILY Dec-19 RIDERS	Dec-20 Dec-19 RIDERSHIP DELTA	AVERAGE DAILY Dec-20 HOURS	AVERAGE DAILY Dec-19 HOURS	Dec-20 Dec-19 HOURS DELTA	AVERAGE DAILY Dec-20 MILES	AVERAGE DAILY Dec-19 MILES	Dec-20 Dec-19 MILES DELTA	AVERAGE DAILY Dec-20 PSNGRMILES	AVERAGE DAILY Dec-19 PSNGRMILES	Dec-20 Dec-19 PSNGRMILES DELTA
WEEKDAY	PRE AM PEAK 04:00AM-05:59AM														
		Census Tract 37	$27,765	1	2	-61.20%	7	7	-0.30%	2	2	0.10%	5	13	-59.50%
		Census Tract 38	$51,375	0	1	-83.20%	5.7	5.3	7.50%	2	2	-0.30%	2	9	-82.20%
		Census Tract 39	$63,668	0	6	-94.70%	5.8	6.6	-12.40%	1.9	1.9	-0.40%	6	23	-72.50%
		Census Tract 4	$55,714	0	0	-87.60%	3.3	2.9	14.20%	0.9	0.8	18.70%	1	3	-63.50%
		Census Tract 40.01	$52,500	3	8	-57.60%	23.1	20.4	13.30%	6.2	6.1	0.80%	5	20	-75.30%
		Census Tract 40.04	$89,782	1	5	-73.40%	19	23.1	-18.00%	4.2	4.4	-4.80%	3	6	-48.10%
		Census Tract 40.05	$67,721	0	2	-93.00%	12.5	13.8	-9.30%	5.1	5	3.10%	5	11	-53.40%
		Census Tract 40.06	$52,292	0	2	-86.10%	6.4	7.3	-12.10%	2.5	2.6	-2.40%	2	8	-69.20%
		Census Tract 40.08	$82,415	0	1	-89.30%	9.5	9.1	4.30%	1.9	1.9	-4.10%	1	3	-48.50%
		Census Tract 40.09	$70,833	3	4	-38.10%	17.7	15.7	12.70%	3.2	3.1	2.90%	2	4	-59.90%
		Census Tract 40.10	$41,184	0	3	-100.00%	4.7	5	-7.10%	1.7	1.7	-1.10%	1	3	-75.90%
		Census Tract 40.11	$107,083	1	3	-57.40%	7	6.6	5.70%	1.9	1.8	6.50%	0	2	-79.80%
		Census Tract 40.12	$119,615	0	0	.	1.4	0.7	87.00%	0.2	0.2	6.90%	0	0	.
		Census Tract 41	$29,635	2	9	-77.20%	13.6	13	4.80%	1.8	1.7	7.90%	1	8	-81.80%
		Census Tract 42.01	$43,365	0	1	-78.20%	5	5.4	-7.70%	1.9	1.9	-0.40%	1	6	-78.90%
		Census Tract 42.02	$36,379	0	5	-96.00%	5.6	6.6	-15.50%	2.3	2.3	-0.40%	2	10	-83.00%
		Census Tract 42.03	$35,568	3	4	-21.00%	12.5	13	-3.50%	2.1	2.2	-3.60%	3	11	-73.50%
		Census Tract 43	$43,819	2	4	-45.60%	7.6	6.7	12.70%	2.2	1.7	28.50%	3	3	-8.80%
		Census Tract 44.01	$36,902	1	3	-62.40%	9.9	9.7	2.20%	2	1.9	5.20%	1	7	-83.20%
		Census Tract 44.02	$23,346	2	4	-60.90%	10	9.9	2.00%	2.1	2.1	2.50%	4	10	-62.90%
		Census Tract 45.01	$27,078	0	0	-100.00%	3.8	3	26.40%	0.5	0.6	-11.00%	1	1	-1.60%
		Census Tract 45.02	$26,466	1	2	-65.70%	13.2	15.5	-14.90%	3.9	4.1	-4.70%	4	12	-69.20%
		Census Tract 46.01	$27,194	0	2	-89.00%	8.5	8.9	-4.60%	2.7	2.7	-0.10%	2	6	-68.20%
		Census Tract 46.02	$34,181	3	6	-50.90%	9.4	10.7	-11.90%	2.6	2.6	-0.50%	5	9	-45.90%
		Census Tract 47.01	$24,107	2	10	-83.20%	24.7	31.1	-20.70%	4.3	4.5	-3.60%	7	21	-65.40%
		Census Tract 48.01	$36,369	1	3	-65.10%	12.5	19.7	-36.40%	3.4	4	-15.20%	3	7	-64.70%
		Census Tract 48.02	$32,364	1	4	-76.30%	11.9	13.7	-12.80%	2.9	2.9	-0.40%	3	7	-58.10%

2.9.20   Social Vulnerability Index

In 2016, well before the COVID pandemic, the Center For Disease Control (CDC) developed a Social Vulnerability Index (SVI) that utilized census information to identify those census tracts that would be more severely impacted by natural disasters than other census tract.

Within UTA's APC Software package is the application of census tract data to identify the most socially vulnerable census tracts in a region and the application of APC-generated data to those socially vulnerable census tracts.

Given FTA's current emphasis in equity in transit service allocation, periodic assessments of the amount of service, quality of service (overcrowding, schedule adherence), and Ridership change will allow the local transit agency to possess current and accurate APC-generated information on service to the most socially vulnerable communities.

Presented below is an example from Westchester County NY representing the March 2020 COVID shutdown period in which the communities with the highest levels of social vulnerability continue to rely on transit to travel to work. These riders were the essential workers traveling to the essential jobs during the shutdown. The most affluent communities (low SVI) were able to work remotely during the March 2020 shutdown.

OVERALL SOCIAL VULNERABILITY RANKING	CENSUS TRACT	PER CAPITA INCOME	OVERALL SOCIOECONOMIC RANKING	OVERALL HOUSEHOLD DISABILITY RANKING	OVERALL MINORITY LANGUAGE RANKING	OVERALL TRANSPORTATION AND HOUSING RANKING	BELOW POVERTY PCT	UNEMPLOYED PCT	NO HIGH SCHOOL DIPLOMA	AGE65 OR OLDER PCT	AGE17 OR YOUNGER PCT	CIVILIAN WITH DISABILITY PCT	SINGLE PARENT HOUSEHOLDS PCT	MINORITY PCT	LIMITED ENGLISH PCT	MULTI UNIT STRUCTURES PCT	MOBILE HOMES PCT	CROWDING PCT	NO VEHICLE PCT	GROUP QUARTERS PCT
223	Census Tract 5	$14,587	2	1	4	24	36.40%	5.50%	41.90%	19.20%	26.60%	20.30%	21.90%	96.20%	20.30%	50.80%	0.00%	8.10%	57.60%	0.40%
222	Census Tract 133	$29,815	1	4	9	18	18.40%	0.90%	35.50%	15.90%	27.90%	12.00%	21.20%	85.40%	20.80%	43.90%	0.00%	8.00%	34.40%	1.80%
221	Census Tract 3	$16,200	24	8	6	3	34.40%	12.80%	42.60%	18.80%	20.80%	14.50%	20.60%	93.40%	21.30%	63.00%	0.00%	17.30%	55.30%	6.20%
220	Census Tract 10	$14,413	18	3	16	1	45.80%	10.80%	28.20%	14.40%	31.20%	17.40%	19.70%	91.40%	13.30%	61.20%	2.10%	10.90%	61.90%	0.80%
219	Census Tract 6	$19,983	6	5	22	7	25.00%	5.40%	28.50%	21.70%	21.50%	14.90%	12.80%	85.20%	13.20%	55.10%	0.00%	9.70%	33.60%	7.70%
218	Census Tract 12	$17,546	27	14	8	12	39.40%	18.40%	34.00%	9.40%	31.10%	11.60%	24.50%	83.90%	22.50%	26.50%	0.20%	17.00%	54.70%	0.30%
217	Census Tract 1.0	$19,897	24	23	4	16	21.10%	7.70%	27.30%	11.70%	25.80%	11.60%	20.50%	97.80%	20.00%	75.00%	0.00%	5.50%	43.10%	1.00%
216	Census Tract 143	$15,990	19	2	14	47	22.80%	8.90%	32.10%	18.30%	27.70%	15.30%	14.60%	85.60%	16.80%	42.10%	0.00%	9.80%	29.50%	0.10%
215	Census Tract 2.0	$16,326	35	31	2	30	19.40%	12.20%	38.30%	10.10%	26.10%	10.80%	23.40%	94.60%	22.50%	64.20%	0.00%	14.60%	58.60%	0.00%
214	Census Tract 36	$21,497	3	49	20	26	23.50%	4.10%	26.50%	11.90%	24.30%	11.30%	12.00%	84.30%	16.20%	33.70%	1.30%	7.90%	37.80%	0.00%
213	Census Tract 63	$20,767	34	29	26	5	14.30%	8.20%	28.70%	18.50%	18.10%	16.70%	8.50%	79.20%	13.70%	52.80%	0.00%	10.20%	40.80%	8.80%
212	Census Tract 13	$16,252	28	51	7	44	29.80%	11.80%	27.60%	7.50%	27.40%	9.80%	17.20%	90.50%	17.50%	50.80%	0.00%	12.50%	41.50%	0.00%
211	Census Tract 33	$29,385	4	6	47	45	13.20%	2.60%	22.70%	19.60%	21.00%	15.10%	18.60%	96.20%	4.30%	22.40%	2.60%	5.70%	29.30%	0.00%
210	Census Tract 11	$10,941	11	54	1	83	58.20%	11.00%	55.10%	5.10%	36.30%	7.60%	25.10%	91.90%	29.70%	7.20%	0.00%	12.20%	49.70%	0.00%
209	Census Tract 80	$21,730	9	119	4	29	24.30%	7.30%	40.80%	8.90%	29.10%	5.90%	12.70%	88.80%	28.80%	35.50%	0.00%	18.80%	32.50%	0.30%
208	Census Tract 79	$22,549	33	97	11	21	12.30%	7.50%	36.10%	11.70%	23.40%	9.40%	12.90%	82.80%	21.80%	35.30%	0.00%	13.40%	21.70%	2.20%
207	Census Tract 4.0	$28,210	48	71	25	15	21.10%	9.70%	23.20%	10.50%	19.80%	12.80%	17.20%	94.20%	9.70%	67.40%	0.00%	7.20%	42.00%	0.80%
206	Census Tract 93	$59,034	97	27	24	20	32.90%	12.60%	25.20%	19.90%	16.90%	12.70%	11.50%	76.70%	18.70%	97.50%	0.00%	2.50%	31.20%	5.10%
205	Census Tract 4.0	$32,766	44	94	27	2	26.80%	8.90%	24.80%	8.10%	24.90%	8.90%	16.70%	85.60%	10.60%	74.10%	1.20%	8.40%	38.80%	1.50%
204	Census Tract 62	$24,946	12	82	24	57	18.60%	6.60%	36.90%	10.10%	25.40%	10.30%	8.70%	72.80%	21.50%	21.20%	0.00%	11.90%	31.10%	0.10%
203	Census Tract 58	$24,115	32	82	19	49	12.70%	7.20%	31.90%	15.00%	21.50%	10.00%	8.80%	76.20%	23.30%	43.80%	0.00%	13.20%	35.20%	0.00%
203	Census Tract 142	$29,998	26	41	39	55	22.90%	7.00%	23.30%	7.90%	25.90%	10.90%	16.80%	68.30%	10.60%	21.10%	0.00%	6.80%	15.00%	0.90%
201	Census Tract 37	$31,610	11	22	43	85	19.50%	5.30%	26.40%	17.80%	19.70%	12.60%	13.00%	73.40%	8.10%	27.40%	0.00%	7.50%	22.20%	0.00%
200	Census Tract 2.0	$35,066	62	13	59	13	21.30%	7.10%	13.30%	24.70%	21.60%	22.50%	5.80%	66.90%	6.20%	93.00%	0.00%	3.50%	38.60%	4.60%
199	Census Tract 1.0	$19,700	8	160	19	4	34.50%	6.10%	19.70%	10.40%	22.50%	5.90%	20.20%	86.80%	13.50%	75.40%	0.00%	8.20%	60.00%	3.30%
199	Census Tract 35	$15,884	38	18	28	98	36.10%	15.30%	24.00%	7.50%	27.10%	13.60%	24.10%	90.20%	9.00%	12.70%	0.00%	5.90%	47.00%	0.00%
197	Census Tract 41	$34,975	69	16	46	38	13.20%	5.60%	10.10%	16.90%	23.80%	10.60%	15.30%	94.30%	4.60%	54.10%	0.00%	11.60%	19.70%	0.20%
196	Census Tract 31	$16,263	40	11	78	9	24.50%	11.50%	21.60%	11.20%	30.30%	14.30%	13.60%	99.40%	1.60%	63.70%	0.00%	10.80%	64.40%	1.30%

2.9.21   'Flag Stop' Service Reporting

UTA's Global Reporting Module has been implemented at several UTA APC sites with strong positive user feedback (e.g., DTC, MDTA, DART, PSTA, SEPTA, MBTA, Savannah-CAT, WATA, COTA, SORTA, VRT, Baltimore-MTA and more).

The term "Flag Stop" refers to observations of Boardings/Alightings at locations not in the Bus Stop inventory. "Flag Stops" may be generated by a bus that is not strictly following a path of known stops at known times. This "Flag Stop" Service can fall under the following:

1) Support Bus, Ad-hoc or On-Call Service
2) Known routes with no time scheduling
3) Deviation from scheduled fixed route service

With Support Bus, Ad hoc or On-Call service, the basic Flag Stop matching is not looking for routing or scheduled times. This level of matching allows for the collection of boardings, alightings, miles, and passenger miles.

If service is designed for Flag Stops, UTA obtains the lat/long of each intersection in the City of Columbia's service area and assigns the passenger activity (boardings/alightings) to the closest intersection. If the quality of the AVL data allows, UTA will provide lat/long for the locations where Flag Stops take place most often.

The example below of a known Route with no Time Scheduling shows a bus-day where the bus stop geocoding is known but the schedule is not known.

```
Route: 999  Pa: 0   Block: 9999     Line: 0       Dir: 0  DBN: 1804    Trip ID: 0
Day: 3     DOW: 3   Vehicle: 305    Date: 040118  Start: 0330   End: 2730
                                                                    Dwell  Trip
ID        Stop Name                       Arrive   Depart   On Off Load  Time  Miles

  9999 00000001 286 W 46th St             S E 08:35:38 08:44:54  28   3  25   9.27   8.25
  9999 00000002 Rockefeller Center        N E 08:48:21 08:49:02   3   0  28   0.68   8.71
  9999 00000015 Port Authority            S W 08:57:59 08:58:14   2   0  30   0.25   9.70
  9999 00000005 Empire State Building     S E 09:12:52 09:13:26  21   3  48   0.57  10.88
  9999 00000008 Washington Square Park    S E 09:25:07 09:25:55   0   2  46   0.80  12.41
  9999 00000009 SOHO                      S W 09:33:25 09:34:27   2   8  40   1.03  13.19
  9999 00000010 Canal Street              S W 09:37:04 09:37:54   0   8  32   0.83  13.58
  9999 00000011 City Hall                 S W 09:41:51 09:43:51   4  13  23   2.00  14.05
  9999 00000012 Battery Park              N W 09:48:29 09:50:07   3   7  19   1.63  14.84
  9999 00000992 World Trade Center        N E 09:56:11 09:57:52   1  16   4   1.68  15.78
  9999 00000015 Port Authority            N E 10:26:27 10:28:23  15  11   8   1.93  19.57
  9999 00000001 286 W 46th St             N E 10:30:03 10:44:02  28  23  13  13.98  19.83
  9999 00000005 Empire State Building     S E 11:17:20 11:18:37  26  11  28   1.28  22.42
  9999 00000006 Flat Iron Building        S W 11:22:58 11:23:15   0   2  26   0.28  23.15
  9999 00000008 Washington Square Park    S E 11:28:03 11:28:13   0   2  24   0.17  23.94
  9999 00000009 SOHO                      S W 11:34:53 11:37:52   7  26   5   2.98  24.70
  9999 00000010 Canal Street              S W 11:41:24 11:43:06  12   0  17   1.70  25.10
  9999 00000011 City Hall                 S W 11:47:55 11:49:19   2  13   6   1.40  25.59
  9999 00000012 Battery Park              N W 11:54:36 11:56:17   0  14   0   1.68  26.41
  9999 00000014 Garment District         N E 12:17:59 12:18:15   0   4   0   0.27  30.37
  9999 00000015 Port Authority            N E 12:26:35 12:31:34  28   9  19   4.98  31.17
  9999 00000001 286 W 46th St             N E 12:35:46 12:48:23   6  12  13  12.62  31.42
  9999 00000002 Rockefeller Center        S E 12:52:47 12:53:34   6   0  19   0.78  31.78
  9999 00000028 Carnegie Deli             N W 12:58:01 12:58:31   4   0  23   0.50  32.19
  9999 00000005 Empire State Building     S E 13:21:33 13:23:54  10   3  30   2.35  34.00
  9999 00000009 SOHO                      S W 13:42:07 13:44:19   1   8  23   2.20  36.31
  9999 00000011 City Hall                 S W 13:53:29 13:56:41   3  11  15   3.20  37.30
  9999 00000012 Battery Park              S W 14:01:57 14:04:42  12  22   5   2.75  37.98
  9999 00000013 Highline                  N E 14:17:27 14:18:08   0  10   0   0.68  40.83
  9999 00000015 Port Authority            N E 14:35:08 14:35:42   0  15   0   0.57  42.69
  9999 00000001 286 W 46th St             N E 14:38:32 14:53:13  18  12   6  14.68  42.97
  9999 00000002 Rockefeller Center        N E 14:57:26 14:57:57   6   0  12   0.52  43.38
```

2.10 UTA APC Administrative Control Module

A primary reason for UTA's longevity in the transit APC marketplace is the ability of UTA's APC system to produce high quality APC analytics over the long term. Within UTA's APC Software package is a number of applications that review the quality and quantity of APC data and produce feedback to the local staff that utilize the APC data. UTA's Administrative Control module is referenced in NTD/APC proposals to FTA which contributes to FTA's 100% approval rate of NTD/APC applications at UTA APC sites.

2.10.1 APC Diagnostics

An important part of the UTA APC Analytic Reporting Tool is the ability to review how well the hardware is functioning. Each tool has a quick 7-day diagnostic check of each vehicle to confirm if it is producing good count data or not. Maintenance staff can review the status of each individual but to confirm which bus and what part on that bus needs maintenance and all users can see how the system is performing overall. The example below is from the University of Virginia where UTA APCs have been installed for at least eight (8) years. Bus 12432 APC sensors are still performing excellent counting 1,355 Boardings and 1,374 Alightings (Percent difference of 1.4%) over the past week.

```
HARDWARE DIAGNOSTICS                                                    UVA
UTA APC System                                                          UTA APC REPORTS


  On  Off D _Date_  Bus  Miles Hours  S/N  WC Bike Sp2 Ini  Clo  104 RdrTC _DBNN_ Day Div   Division      POGarage Mile  Delta

  232  236 1 111620 12432  78.4 22.9 12432   2   0   0   1  193  0.0  1.2 201123  4   1       UVA           UVA   0.0   0.0   1.7%
  237  231 1 111720 12432  79.8 24.0 12432   6   0   0   0  201  0.0  1.2 201123  5   1       UVA           UVA   0.0   0.0   2.5%
  273  281 1 111820 12432  81.6 24.0 12432   2   0   0   0  209  0.0  1.3 201123  6   1       UVA           UVA   0.0   0.0   2.8%
  254  256 1 111920 12432  82.7 24.0 12432   2   0   0   0  223  0.0  1.1 201123  7   1       UVA           UVA   0.0   0.0   0.8%
  189  193 1 112020 12432  78.4 16.6 12432   2   0   0   0  166  0.0  1.2 201123  8   1       UVA           UVA   0.0   0.0   2.1%
  170  177 1 112320 12432  53.4 10.2 12432   2   0   0   1  147  0.0  1.2 201123  4   1       UVA           UVA   0.0   1.3   4.0%
  ------------------------------------------------------------------------------------------------------------------------------
   On:  1355 Off:  1374 Diff:   19 Delt:  1.4%                                                      Avg:   2.3%
                             QC104:  0.0

Vehicle:  12432     (data)
          12432     (APCBus.ref)
Miles:     454
Start:    04:37:03  11\16\20
End:      14:47:53  11\23\20
Last Lat Long:    38.035282 -78.508308




Data Days: 70  Chron Days: 75  Yield: 0.93


 1 UVA           29 of  30 APC's reporting

APC's reporting in last 7 days:          29
APC's in APCBus.ref:                     30
APC's reporting with suspect GPS:         0
APC's reporting with suspect counts:      0
APC's reporting with good counts and GPS: 29
```

4240 Airport Rd, Suite # 212, Cincinnati, Ohio 45226. Tel (513) 961 0099 Fax (513) 961 0132   Page 63

2.10.2   Sampling Status

During the current COVID19 quarantine it was imperative that LADOT track how well their service was operating. LADOT operates routes from five (5) bus yards throughout the entire Los Angeles County area. The Sampling Status report allowed staff to monitor which routes were operating consistent to the scheduled service and which were being adjusted by operational conditions.

2.10.3   Geocoding Accuracy and Comprehensiveness

UTA's Geocoding Accuracy and Comprehensiveness reporting presents the level of concurrence between the Calibrated Lat/Long and the Actual Lat/Long at each Bus Stop. This analysis is utilized to refine GTFS Bus Stop calibration as well as identifying errors/omissions in the original bus stop calibration file. A recent application of this tool identified over 200 missing Bus Stops from a transit agency's GTFS export.

APC RIDERSHIP STATISTICS
****
APC STOP SUMMARY - LOCATION SUMMARY
DOOR OPEN-CLOSE OBSERVATIONS ONLY
Rt - 41
Aug 2021 Schedule
Weekday
****

DIR	SEQENTL STOP NO	UNIQUE STOP NO	NAME	AVG LATITUDE	AVG LONGITUDE	AVG DELTA	STD DEV DELTA	AVG DWDI	SAMPLES
Outbound									
	1	1681	22ND MAIN - N	30.451930	-91.165954	35	9	2	7
	2	1682	22ND NORTH ST - N	30.452994	-91.165996	22	11	4	8
	3	1683	22ND EDGEWOOD - N	30.454830	-91.166034	30	11	2	7
	4	1684	22ND FUQUA - N	30.457259	-91.166124	12	9	3	38
	5	1685	22ND PLANK - N	30.461277	-91.166410	29	9	0	3
	6	1686	PLANK BIRCH - N	30.463335	-91.165891	45	17	12	13
	7	1687	PLANK WASHINGTON - N	30.465033	-91.165250	44	37	12	20
	8	1688	PLANK FAIRFIELD - N	30.466384	-91.164778	78	26	6	14
	9	1912	PLANK ADAMS - N	30.468388	-91.164060	39	46	6	13
	10	1913	PLANK CHOCTAW - N	30.469667	-91.163617	13	9	53	17
	11	1914	PLANK SENECA - N	30.471178	-91.163067	21	23	3	70
	12	1915	PLANK CHIPPEWA - N	30.472967	-91.162060	238	624	39	26
	13	1916	PLANK DALTON - N	30.473719	-91.162175	21	10	3	12
	14	1917	PLANK ONTARIO - N	30.475142	-91.160745	298	686	24	26
	15	1918	PLANK HURON - N	30.476911	-91.160810	105	338	2	23
	16	1919	PLANK WINBOURNE - E	30.478120	-91.160377	102	319	10	49
	17	1920	PLANK OSWEGO - N	30.480285	-91.159864	23	27	1	25
	18	1921	PLANK WYANDOTTE - N	30.481972	-91.159270	22	12	2	49
	19	1922	PLANK WINNEBAGO - N	30.483208	-91.158701	58	180	2	36
	20	1923	PLANK MOHICAN - N	30.484660	-91.158335	20	10	3	30
	21	1924	PLANK WELLER - N	30.485585	-91.158014	29	11	2	25
	22	1925	PLANK PRESCOTT - N	30.486912	-91.157138	132	535	3	21
	23	1926	PLANK DAYTON - N	30.488299	-91.157045	27	10	2	16
	24	1927	PLANK CLAYTON - N	30.490249	-91.156368	35	51	6	44
	25	1928	PLANK EVANGELINE - N	30.492504	-91.155547	68	60	8	68
	26	1929	PLANK SYCAMORE - N	30.494419	-91.154868	28	27	2	27
	27	1930	PLANK DELMONT VILLAGE - N	30.495295	-91.154560	46	13	2	69
	28	1931	PLANK ST GERARD - N	30.497198	-91.153887	32	28	2	74
	29	1932	PLANK RILEY - N	30.498854	-91.153308	126	20	3	56
	30	1933	PLANK VAUGHN - N	30.501270	-91.152458	41	62	2	26
	31	1934	PLANK JH COONEY - N	30.502904	-91.151883	18	11	1	16
	32	1935	PLANK DENHAM - N	30.504335	-91.151384	25	28	3	31
	33	1936	PLANK CANNON - N	30.505175	-91.151091	13	8	3	86
	34	1937	PLANK DAWSON - N	30.506701	-91.150546	43	20	2	34
	35	2292	AIRLINE HWY BEECHWOOD - S	30.509139	-91.143982	31	35	2	30
	36	1938	AIRLINE FOSTER - S	30.508509	-91.140795	12	7	3	13
	37	1939	MCCLELLAND AIRLINE - S	30.505706	-91.135463	27	8	3	43
	38	1940	MCCLELLAND TOLBERT - S	30.504458	-91.135430	221	29	2	4

2.10.4   Assignment Performance

UTA's Assignment Performance software compares the amount of APC data being imported into the analytic reporting against the total amount of APC data collected. Periodically, APC data is lost by AVL systems if the bus is off-route or if there is a missing or inaccurate Driver Login.

			ASSIGNMENT PERFORMANCE							
			HIGH MILEAGE DIFFERENCE - LOW ON DIFFERENCE							
			Aug 2021 Schedule							
			****************************							
			DIAGNOSTIC				DIAGNOSTIC			
			DAILY TOTALS	.TOT	PRCT		DAILY TOTALS	.TOT	PRCT	
COACH	BLOCK	DATE	MILES	MILES	DIFF	DIFF	ON	ON	DIFF	
------	--------	--------	------------	----------	------	------	------------	----------	------	
192	0	01/03/22	180.9	166.6	7.9	14.3	108	108	.0	
192	0	01/04/22	98.8	91.5	7.4	7.3	73	73	.0	
192	0	01/06/22	108.1	100.9	6.7	7.2	104	103	1.0	
192	0	01/11/22	177.0	163.3	7.7	13.7	95	95	.0	
192	0	01/14/22	98.6	90.3	8.4	8.3	60	60	.0	
192	0	01/16/22	215.8	198.9	7.8	16.9	65	64	1.5	
192	0	01/17/22	252.8	233.1	7.8	19.7	64	64	.0	
192	0	01/23/22	23.2	32.2	-39	-9.0	23	23	.0	
192	0	01/24/22	10.5	3.1	70.5	7.4	22	22	.0	
192	0	01/25/22	15.6	15.8	-1.3	-.2	29	29	.0	
192	0	09/02/21	196.1	181.5	7.4	14.6	230	230	.0	
192	0	09/03/21	214.2	197.9	7.6	16.3	84	84	.0	
192	0	09/05/21	234.0	215.8	7.8	18.2	106	106	.0	
192	0	09/16/21	208.9	193.4	7.4	15.5	2	2	.0	
192	0	09/19/21	82.4	76.3	7.4	6.1	2	2	.0	
192	0	09/23/21	179.9	166.8	7.3	13.1	2	2	.0	
192	0	09/24/21	207.2	191.6	7.5	15.6	5	5	.0	
192	0	09/27/21	256.5	236.6	7.8	19.9	2	2	.0	
192	0	09/28/21	220.4	203.7	7.6	16.7	0	0	.0	
192	0	09/30/21	144.6	138.9	3.9	5.7	3	3	.0	
192	0	10/03/21	201.6	186.3	7.6	15.3	4	4	.0	
192	0	10/08/21	177.7	164.4	7.5	13.3	136	136	.0	
192	0	10/10/21	248.1	228.6	7.9	19.5	102	102	.0	
192	0	10/15/21	202.5	187.5	7.4	15.0	145	144	.7	
192	0	10/23/21	158.4	146.9	7.3	11.5	180	158	12.2	
192	0	10/26/21	230.6	213.0	7.6	17.6	98	98	.0	
192	0	10/28/21	229.6	212.0	7.7	17.6	125	125	.0	

2.10.5 Segment Contiguity

The Segment Contiguity review identifies Missing Timepoints. For On-Time Performance and Running Time analyses, it is critical that all Timepoints be identified by the AVL and/or APC system. Presented below is an example from Capital Area Transit:

```
PAGE    1                                       Capital Area Transit System
                                 **********************************************
                                             SEGMENT SAMPLE REPORT
                                            NON-CONTIGUOUS SEGMENTS
                                               Aug 2021 Schedule
                                 **********************************************
                                        NON-CONTIGUOUS  TOTAL           AVG
                        OLD          NEW              SEGMENT  TRIP    FREQ OF  RUN   AVG   STD DEV                           LAST
 ROUTE    DIR   PATTERN TIMEPOINT    TIMEPOINT   POSTN SAMPLES  SAMPLES NON MATCH TIME  DIST   DIST  DELTA1 DELTA2 DWDI1 DWDI2 TIMEPOINT

  8       0             CATS         BRCC        103     3       388      1%    13.4  3.03   .90    255    41    337    0   GUSYNGCOLODUNN

 TOTAL                                                   3

 12       0             MALLOFLA     CATS        104     5       .        .     28.4  8.46   .05     53    47     57  744   INDEPENDENCEDMV
          1             CATS         MALLOFLA    104     4       .        .     25.6  8.23   .05     13    20    121   72   JEFFERSONDRUSILLA

 TOTAL                                                   9

 17       0             CATS         MALLOFLA    104     2       370      1%    14.0  7.65   .07    271    31   1543   57   ONEPERKINSPL
          1             MALLOFLA     CATS        104     2       .        .     29.4 10.40  4.24     32   201     20  124   PERKINSCOLLEGE

 TOTAL                                                   4

 21       0             CATS         NBONMARCHEHARR 103  28       321      9%    35.3  7.18   .78    833   500    227   29   FAIRFIELDSFOSTER
                                     Y
          1             CORTANAWALMART FAIRFIELDSFOST 103  3      324      1%    24.8  4.60  1.56    159    38      0    0   NBONMARCHEHARRY
                                     ER
          1             CORTANAWALMART CATS      104    29       324      9%    32.6  7.33   .57    113   871     14  219   FAIRFIELDSFOSTER
          1             NBONMARCHEHARR CATS      204     2       324      1%    10.1  3.20   .42    563   959    233    0   FAIRFIELDSFOSTER
                        Y

 TOTAL                                                  62

 22       0             WINBOURNEACADI EUROPESTREET 305  4       142      3%    25.7  6.78   .21     34    35      0   23   RIVER3RDDEPART
```

2.10.6   2.6 Bus Stop Identification Refinement

The Bus Stop Identification Refinement application that compares the Bus Stops identified by the APC system against the Bus Stop Calibration file provided by the City of Columbia. Periodically, there are short-term detours (accidents, street repairs, etc.) that are not incorporated into the official Bus Stop geocoding files. However, the APC system is collecting data on Trips that are partially detoured. This UTAAPC Administrative Control tool identified the frequency with which a Bus Stop has been identified relative to the Number of Trips Operated. From this analysis, Route Exceptions can be added to UTA's Bus Stop Identification algorithms that will increase the frequency (to virtually 100%) of identification of a given Bus Stop.

Presented below are tables that present a Before and After the application of this tool:

Identified bus stops that are not matching on each sampled trip.

Route	Pattern	DIR	Seq	Unique	Stopname		STOP_TRIP_PRCT
36	PATLB1	0	4	4231010	5th @ Marquette		0.87
36	PATLB1	0	5	70423003	5th @ Fruit		0.87
36	PATLB1	0	6	4727	Lomas @ 7th		0.83
36	PATLB1	0	7	4729	Lomas @ 11th		0.83
36	PATLB1	0	8	4731	12th @ Granite		0.83
36	PATLB1	0	9	4733	12th @ Rosemont		0.83
36	PATLB1	0	10	4735	12th @ Arias		0.83
36	PATLB1	0	11	4737	12th @ Bellamah		0.83
36	PATLB1	0	12	4739	12th @ Bellamah		0.83
36	PATLB1	0	13	4741	12th @ I-40		0.83
36	PATLB1	0	14	4230965	12th @ Indian School		0.83
36	PATLB1	0	15	4745	12th @ Indian School		0.83

Reprocessed bus stop data calibrated to refine data yield. The refined data shows the stops matching 100% on each sampled trip.

Route	Pattern	DIR	Seq	Unique	Stopname		STOP_TRIP_PRCT
36	PATLB1	0	4	4231010	5th @ Marquette		1.00
36	PATLB1	0	5	70423003	5th @ Fruit		1.00
36	PATLB1	0	6	4727	Lomas @ 7th		1.00
36	PATLB1	0	7	4729	Lomas @ 11th		1.00
36	PATLB1	0	8	4731	12th @ Granite		1.00
36	PATLB1	0	9	4733	12th @ Rosemont		1.00
36	PATLB1	0	10	4735	12th @ Arias		1.00
36	PATLB1	0	11	4737	12th @ Bellamah		1.00
36	PATLB1	0	12	4739	12th @ Bellamah		1.00
36	PATLB1	0	13	4741	12th @ I-40		1.00
36	PATLB1	0	14	4230965	12th @ Indian School		1.00
36	PATLB1	0	15	4745	12th @ Indian School		1.00

2.10.7   APC Reference File Quality Control

With appropriate review of transit schedules and geo-coding information from one schedule change to another, transit agencies implement a successful APC Reference File Quality Control procedure to provide accurate reports and analysis. UTA will apply its APC Reference File Quality Control measures at the City of Columbia to identify scheduling and/or geo-coding anomalies. Outlined below is brief description and schematic of the APC Reference File Quality Control process.

2.10.8   Automated Overnight APC Data Processing

UTA's APC Reporting Software begins with an overnight APC data processing routine scheduled to start after the last bus comes into the garage for the night; and is designed to complete before schedulers and planners arrive each morning. The goal of UTA's APC Reporting Software is to provide schedulers and planners a complete set of analytics at their fingertips that is valid, comprehensive and updated to yesterday.

The overnight data processing is a five-step procedure consisting of four UTA software modules.   Each Software Module performs a basic task that builds on the previous, while consisting of its own data validity checks. Each module provides output that allows for data transparency and auditability.

Software Group	Function	Purpose
Concatenate	Merge Raw Data	Converts raw APC data to application file.
Diagnostics	Provide APC Hardware Diagnostics	Determines APC data quality and anomalies for maintenance purpose.
Assignment	Determines Bus to Block Assignment	Automatically determines the University of New Mexico Block operated by each bus.
File Creation	Creates User-Defined Aggregated Databases	Creates ascii.txt files subsequent reporting and potential database applications.
Database Load	Load data into UTA cloud hosted database	Makes data directly available for users to query from their desktop.

Automated Overnight Data Processing Input

The overnight data processing requires the following reference files at the start of each schedule period.

APC Reference File	Data Source	APC Function
Master Schedule	GTFS/ City of Columbia	Service Provided
Bus Stop Calibration	GTFS/ City of Columbia	Bus Stop Identification
Calendar	GTFS/ City of Columbia	Determine Service Schedule
APC BUS	City of Columbia /UTA	Provides List of Active APC Vehicles
Route Exception	UTA	Routing Idiosyncrasies

Automated Overnight Data Processing Output

At start of each business day the automated overnight data processing has prepared the following: diagnostic reports and processed data files.

The diagnostic reports are in easy-to-read file formats (.txt and .csv) that provide both an APC system administrator a clear understanding of how the APCs are performing across the bus fleet, as well as a maintenance technician precise details of what needs to be repaired and where to repair it.

The processed data files give schedulers and planners the analytics they need with the data quality control included. Schedulers and planners do not need to exercise data cleansing procedures.

Filter/Edit Software

In the practical day-to-day operation of a transit system, deviations from normal operating proce-dures sometimes occur. Given a degree of transit operational anomalies and APC system anomalies, the Filter/Edit subsystem serves a critical role by filtering out and/or editing anomalous data. The algorithms present in this subsystem are the result of years of reviewing APC data and determining the optimal set of criteria for maximizing the rejection of anomalous data. Two (2) examples of such algorithms are described below.

- **UTA Trip Balancing Algorithm**
  Typical APC sensors generate APC Passenger Counting accuracies in the 95%+ range. UTA APC Trip Balancing algorithm identifies any discrepancy in the total boarding and alighting and balances the trip total by applying the missing boardings/alightings to appropriate bus stops.
- **UTA End of Line Load Adjustment Algorithm**
  To prevent APC hardware counting errors to propagate from trip to trip, UTA's APC Load Adjust algorithm identifies illogical passenger load at the end of the line location and adjust the load to a logical value. UTA's advanced EOL Load Adjustment algorithms provides more accurate passenger loads and passenger miles for NTD reporting and other analytical needs than more simplified EOL Load Adjustment algorithms.

2.10.9 Real-Time Passenger Load Capability - Optional

The benefits of using cellular APC data transfer are both reliability and the opportunities of real-time APC data. The UTA APC system offers a real-time passenger load module which can inform GoCOMO dispatchers and staff where heavy loads and bus bunching is occurring in the City of Columbia network. The image of the UTA interface below from Tempo Line buses in Oakland, CA shows the buses traveling on the street network in real-time with color coded icons demonstrating the current load levels on the bus. Users may select from different alert notifications such as screen pop-ups when a bus reaches the overcrowding threshold, email alerts, color coded icons and table rows flashing. The table to the right of the image allows users to sort active status by user-defined statistics. During the COVID-19 pandemic UTA added the ability for users to define their own bus capacity levels to meet their local social distancing requirements.
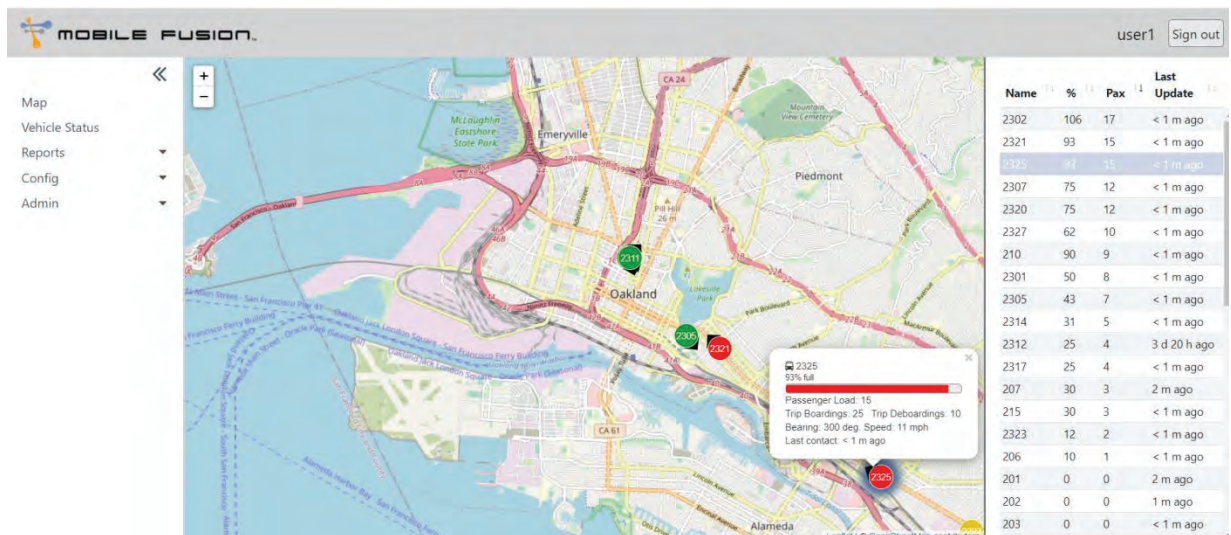
UTA APC hardware and data transfer also supports exporting the APC count, location, bike rack usage and time status to different transit agency vendor applications in real-time. Currently, UTA is providing APC data for real-time display for High Point, NC, Williamsburg, VA, Ft. Wayne, IN, and Antioch, CA.

2.11 Training

APC Software Training

The objective of the APC Software Training is for the City of Columbia to achieve a level of competence in understanding and operation of the APC Analytic Software package that the City of Columbia becomes totally independent of any UTA's support while realizing the full analytic value of the APC system.

The specific durations of the APC Software Training elements presented below are subject to mutual agreement between UTA and the City of Columbia.

The APC Software Training will begin after all of the APC Analytic Software has installed/tested and is routinely generating a standard set of APC reports/plots. The components of the APC Software Training are presented below:

APC Analytic Report Menu Training

The initial training will cover how to use the UTA APC Analytic Reporting web site and review what analytic content is available from the web site. This training session will consist of a minimum of two 1.5 – 2-hour sessions and can be conducted on-site or remotely via a video conferencing preferred by local the City of Columbia IT (Zoom, Teams, WebEx, etc.) The first session will be a comprehensive review of the web site where each analytic report will be generated and UTA and the City of Columbia staff will review all of the content and the mechanics of running a report. One goal of the first session is for local the City of Columbia staff to inform UTA of any customization they request out of the tool, notably different fields it will want added or removed from the reports.

In the second session we will review the web site analytics for practice and confirm the customizations requested by the City of Columbia have been added to the staff's satisfaction.

Since the City of Columbia configuration will be UTA hosted the UTA APC overnight data processing will only be quickly reviewed since this will be managed by UTA staff. The data processing reference file input will be the focus of this portion of training.

APC NTD Certification Training

After the City of Columbia staff demonstrate satisfactory proficiency in the execution of the APC Report Generation; the next session will address the APC NTD Certification Training.

This session will present to the City of Columbia staff and management the FTA provided guidelines and procedures for how to get the City of Columbia system certified for NTD reporting. In early 2017 the FTA published a newly defined procedure for NTD certification. This procedure must be repeated by the transit agency in every fiscal year divisible by 3 (2022, 2025, 2028, etc.). This training will explain how to get this task completed and include a UTA Best Practices guide to performing on-bus (or video) ridechecks which validate the accuracy of the APC data. The NTD certification procedure typically services as the APC validation procedure for transit agencies when purchasing a new APC system.

APC System Administration

At this point in the APC Software Training cycle, City of Columbia staff should be executing all procedures quite well. Again, if this is not the case, UTA will allocate time/resources to eliminate any APC Software operation related problems.

This session will present to the City of Columbia staff and management those areas of APC operation that should be closely monitored/reported to achieve a continual high level of APC performance. Many

of the areas addressed in the APC System Administration training will concentrate on the transfer of information relative to the APC system to other City of Columbia departments. Communication of APC maintenance tasks/corrective actions, APC vehicle deployment, APC data yields, Sampling priorities, Analytic Report requests, etc. are the types of subjects that will be defined in this session.

It is the policy/practice of UTA to provide indefinite APC Software support to UTA APC users.

APC Hardware Maintenance Training

On site APC hardware training conducted by the same experienced UTA technicians that installed the APC equipment at the City of Columbia will be provided in APC hardware-training sessions. As with the APC Software Training, the objective of the APC Hardware Training is to make the City of Columbia completely self-sufficient in the long-term support of the APC system.

The APC Hardware Training can be scheduled over multiple sessions. Quite simply, UTA's APC system does not fail very often. As a result, the APC training given to local transit maintenance staff does not get practiced very much and the APC maintenance skills obtained in the initial APC training tend to atrophy from lack of application.

An initial introduction/explanation of the APC system is appropriate along with detailed exposure to the APC maintenance procedures. Presented below are the topics to be covered:

APC Maintenance Training

- o   Review On Board Wiring Runs and Terminations
- o   Review APC Equipment Repair Manual
- o   Input Power Placement
- o   Counting Sensor Placement and Adjustment
- o   GPS Subsystem (Review of UTA APC Diagnostics)
- o   WLAN/Cellular Data Transfer
- o   Discrete Inputs (doors)
- o   Use of Diagnostic Laptop Computer
- o   Common Problems/Repairs

2.11.1 APC System Support

UTA considers the support of an APC system to be equally important as the on-vehicle hardware and analytic software in a successful APC implementation. Presented below is a description of a common UTA APC Support agreement:

2.11.2 Objective

It is the objective of UTA to provide the City of Columbia with APC-generated information that will directly improve the productivity and quality of City of Columbia service for the tenure of the APC Support agreement.

On-Bus Hardware Maintenance and Support

On the APC Server, each morning at 03:00 AM local, UTA's APC Diagnostic software applies a number of diagnostic algorithms to the raw APC data in order to obtain a reliable assessment of APC data quality and quantity. The APC-equipped buses with maintenance needs are identified. UTA will assume primary responsibility for the review of the APC Diagnostics and the subsequent identification of buses that require APC maintenance. APC Diagnostic information will be posted to the APC Analytic Reporting Tool web site that is accessible to City of Columbia staff. Automated emails with the reports can be generated as well.

UTA will provide the labor and materials that will allow the City of Columbia to maintain a satisfactory APC Data Yield for the term of the contract. APC Data Yield is defined as the ratio of Valid Data Days and the Total Chronological Days in a given period. The term 'satisfactory APC Data Yield' will be defined as providing a statistically valid sampling of all Weekday revenue service each week. The APC system will be maintained at an optimal level in order to produce 3-5 samples of each Weekday Revenue Trip during a given week.

To achieve this level of performance, UTA will provide an average 2-3 week response time to address APC system malfunctions. If the overall APC Data Yield approaches an unsatisfactory level for a given chronological period (week, month), UTA will dispatch the appropriate number of APC technicians to address the APC maintenance needs and return the APC Data Yield above the target APC Data Yield threshold.

UTA's technician residing in Northern California will provide on-site APC maintenance which will be performed primarily on evenings and weekends.

The following outlines the contact information and response policy for City of Columbia-initiated requests and inquiries.

Priority Category	Examples	UTA POC	Support Hours and Response Policy
Noncritical Issues	General Inquiries Any issue not having major impact on APC system functionality	Nick Fischer (513) 961-0099 Nick.fischer@utatransit.net	Hours of Availability (8 a.m. – 5 p.m.) and response time (within 24 hours)
Critical Issues	Issues having a severe impact on system functionality	David Vanderputten (513) 961-0099 dvander@utatransit.net	Response time within 24 hours

In the event that a particular APC component exhibits a consistent failure rate, UTA will provide a complete replacement for the subject component.

This APC Maintenance agreement covers all APC malfunctions that result from normal transit operations consistent with the frequency and type of APC malfunctions that have been observed at Florida transit agencies. APC failures of high frequency and magnitude attributable to unusual vandalism, gross negligence, and/or acts of nature will not be included in the APC Maintenance Agreement. UTA and the City of Columbia will negotiate the remedy of such unusual conditions.

Repairs that are not associated with or attributable to vandalism but are associated with component failure shall be guaranteed for at least ninety (90) days after the last UTA APC maintenance corrective action. In the event the repaired component fails again within 90 days, UTA agrees to repair or replace the component at no further expense to the City of Columbia. The City of Columbia recognizes that there may be instances of unusual or extreme circumstances where multiple conditions or factors are contributing to the component failure. UTA will be responsible for notifying the City of Columbia of such unusual or extreme circumstances. In such instances, the ninety (90) day period may be deferred by mutual consent of the City of Columbia and UTA.

Within three (3) business days of each UTA APC Maintenance application at the City of Columbia, UTA will summarize the APC Maintenance efforts in an Excel file that contains: Date, Bus Number, Time of Day, Problem Reported, Diagnosis, and Corrective Action. The maintenance records will be provided via e-mail to the City of Columbia.

2.11.3 APC Software Support

In addition to executing on-bus APC equipment maintenance UTA will also provide support in the administration and management of the APC Software component of the City of Columbia's APC system.

Review/Summarization of On-Bus APC Hardware Performance

On a quarterly schedule, UTA will provide the City of Columbia with a summary of APC Data Yield along with a summary of APC equipment performance status. This information will provide City of Columbia management and staff with an up-to-date status of the APC system. The City of Columbia will also have access to APC Diagnostics and APC Data Yields via the UTA APC Analytic web sites (automated emails containing diagnostic status are also available).

APC Maintenance Summary

UTA will provide a summary of the APC maintenance performed on each APC-equipped bus during the previous period. All APC maintenance will be electronically stored in an Excel file that would contain the following information: Bus No., Division, Date, Time of Day, Technician, Problem Reported, Corrective Action, Materials Applied, and Repair Time Required. The APC Maintenance Summary will be provided in both an MS Word document and Excel export.

Schedule Export/APC Conversion

For each schedule period, the City of Columbia will provide UTA with a GTFS export and other data as required to create a Schedule Export in the specified APC format. UTA will also execute the Data Quality checks that will identify any anomalies/errors/omissions in the Master Schedule file export. UTA will communicate the results of the Reference File Quality review to the City of Columbia for resolution.

Bus Stop and Time Point Export/APC Conversion

Similar to the GTFS export, UTA will support and assist the City of Columbia staff in the setup of Bus Stop and Time Point reference files for each schedule period.

For each schedule period, UTA will execute the conversion of the City of Columbia's Bus Stop and Time Point export into the specified APC format. UTA will also execute the Data Quality checks that will identify any anomalies/errors/omissions in the Bus Stop and Time Point exports. UTA will communicate the results of the Data Quality review to the City of Columbia for resolution.

Post Schedule Change APC Data Quality Review

After one (1) week of APC data collection in a new schedule period, UTA will assist and support the City of Columbia staff in executing a number of APC Administrative Control analyses that will identify any inconsistencies/anomalies in the APC data that require resolution. Examples of analyses include:

Sampling Status - Check for missing Routes

Trip SOL/EOL Matching - Check for SOL/EOL anomalies

Not Identified Bus Stops – Check for missing Bus Stop geo-coding

From this APC Data Quality Review, UTA and City of Columbia staff will execute any necessary revisions to the schedule and geo-coding files, re-execute the file conversion, and reprocess the set of APC data collected since the start of the schedule period.

Monthly and Schedule Period APC Data Processing Setup

UTA will assume responsibility for executing the changes to the standard automated APC data processing modules. For each schedule period, the APC Data Transfer, APC Diagnostics, APC Automated Assignment, APC File Creation, and APC Database Loading modules will be modified to reflect the correct parameters and schedule period.

Route Idiosyncrasies Identification/Setup

As needed, UTA will execute the setup and any applicable modifications to APC algorithms to reflect unusual service operating conditions. Factors such as construction, special events, customer requests, etc. may require modification to standard APC software procedures. UTA and City of Columbia staff will collaboratively identify the operational condition and, if appropriate, UTA will adapt the APC software to accommodate the unusual operating condition.

Latest versions of UTA APC Analytic Reporting Tool

The City of Columbia will have access to a password-protected secure web page with an analytic reporting tool to query all of their APC data.

Ad-Hoc APC Reporting

UTA will provide support to meet ad-hoc reporting requirements that fall outside the standard APC Reporting website. Examples include: APC data exports requested from outside organizations (consultants, MPO's, etc.), special requests from senior management and/or local political leaders, NTD audits, and other non-standard requests.

APC System Performance Status Meetings

On quarterly or semi-annual basis, UTA and the City of Columbia will hold meetings to discuss APC System status and near-term APC plans. Included in these APC status meetings will be staff from the City of Columbia Planning and Scheduling departments in order to assure that the City of Columbia analytic needs are being met with the City of Columbia's APC system.

EXHIBIT B

CONTRACTOR'S PRICING PAGE

City of Columbia Mo (GoCOMO)
APC System Cost Summary
Qty=25 Buses - StandAlone Configuration
Rev002 - 09/14/23

APC On-Bus Complete System – Utilize Existing APC Sensors

Item	UTA Part No.	Per Bus Cost
A. Model 31 APC Interface Module	5541LW	$ 1,675
B. Cables (2)		$ 474
C. Antenna (GPS/Cellular)		$ 190
	Per Bus Total	$ 2,339
Installation - UTA Technicians		$ 375

Item	Per Site Cost
Cellular Data Transfer (3 Years)	$ 6,525
($7.25/bus/mo)(25buses)(36mo)	
APC Training & Documentation	4,100
Warranty – Two (2) Years	2,500
Per Site Total	$ 13,125

Total Project Cost $ 80,975

Annual APC Support

Year 1	**$ 0**
Year 2	**$ 7,500**
Year 3	**$ 7,875**
Year 4	**$ 8,269**
Year 5	**$ 8,682**

Notes:

1. **Delivery: 6-8 Weeks ARO**
2. **Optional: Real-Time Passenger Load GTFS-RT - $ 8,750/yr**
3. **Taxes Not Included**

Optional - UTA APC Software Upgrade

APC Software -   Web-Based – UTA Hosted $ 33,500

APC Software Package
   Data Transfer
   Diagnostics
   Automated Assignment
   File Creation
   Report Generation
   NTD Certification Proposal/Qualified Statistician

Optional - UTA APC Sensor Upgrade – Horizontal to Hella

Six (6) Buses w/Hella (1965, 1966, 1368, 1369, 1366, 1367)   **No Cost**

Nineteen (19) Buses w/Horizontal   **$ 1,975/bus**